Universidade do Minho
Escola de Engenharia
Departamento de Informática

Artificial Intelligence: Past, Present and Future

LICENCIATURA EM ENGENHARIA INFORMÁTICA
MESTRADO integrado EM ENGENHARIA INFORMÁTICA
Inteligência Artificial
2025/26

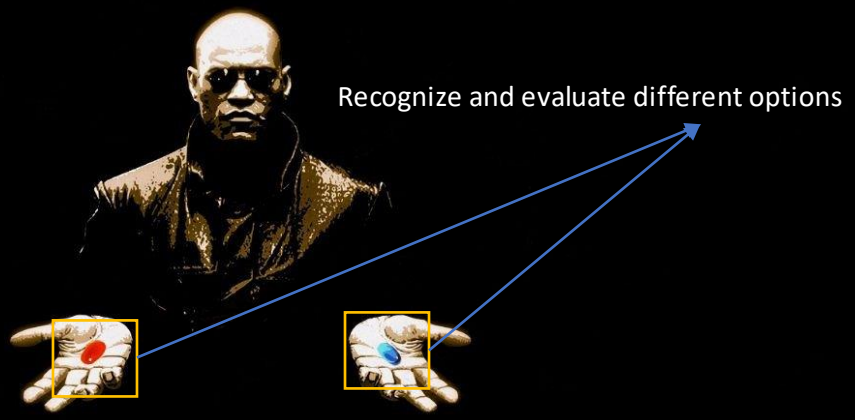
Wachowski, 1999

This is your last chance. After this, there is no turning back. You take the blue pill - the story ends, you wake up in your bed and believe whatever you want to believe. You take the red pill - you stay in Wonderland and I show you how deep the rabbit-hole goes.

Matrix (1999), Morpheus to Neo

Source: Davide Carneiro (IPP)

Wachowski, 1999



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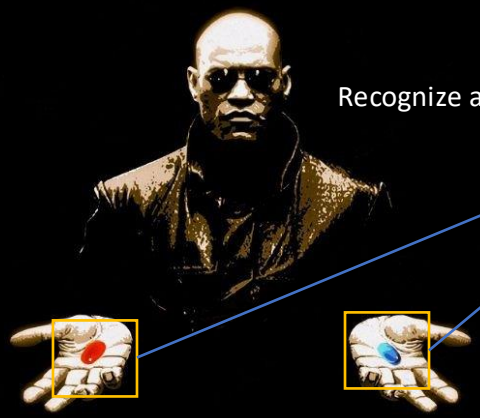

Recognize and evaluate different options

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Imagination, abstract thinking, conception

Source: Davide Carneiro (IPP)

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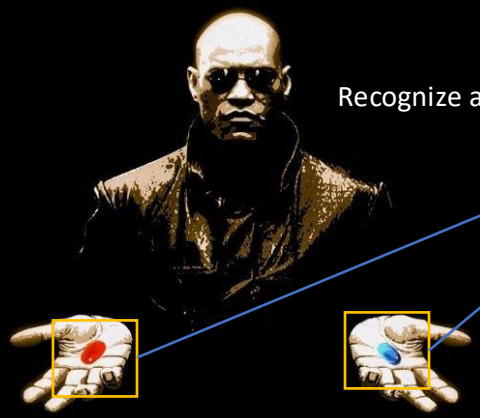

Recognize and evaluate different options

Memory

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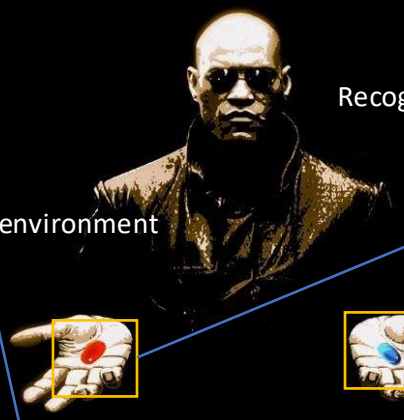

Recognize and evaluate different options

Awareness, understanding the environment

Memory

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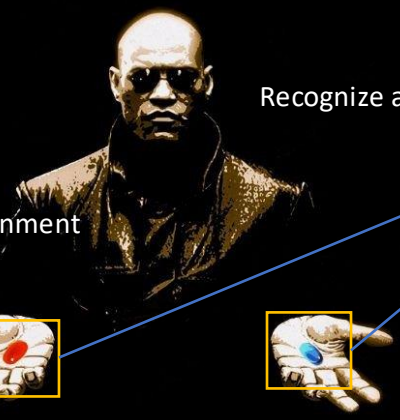

Recognize and evaluate different options

Awareness, understanding the environment

Memory

"Free will"

This is your last chance. After this, there is no turning back. You take the blue pill - the story ends, you wake up in your bed and believe whatever you want to believe. You take the red pill - you stay in Wonderland and I show you how deep the rabbit-hole goes.

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Definitions

- Intelligence

  (...)
  from Latin 'intelligentïa', 'faculty of understanding, talent'.

Artificial

that is done by art or industry; that is not natural (...)

Will computers replace man?

Will computers, intelligent machines, humanoid robots have the ability to think and decide to make them capable of replacing man?

Will computers replace man?

The Demythification

Will computers replace man?

NO

Computers are ALREADY replacing man!

And it is not just about doing the same thing as man.

Computers are able to do better than man.

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Solve puzzles

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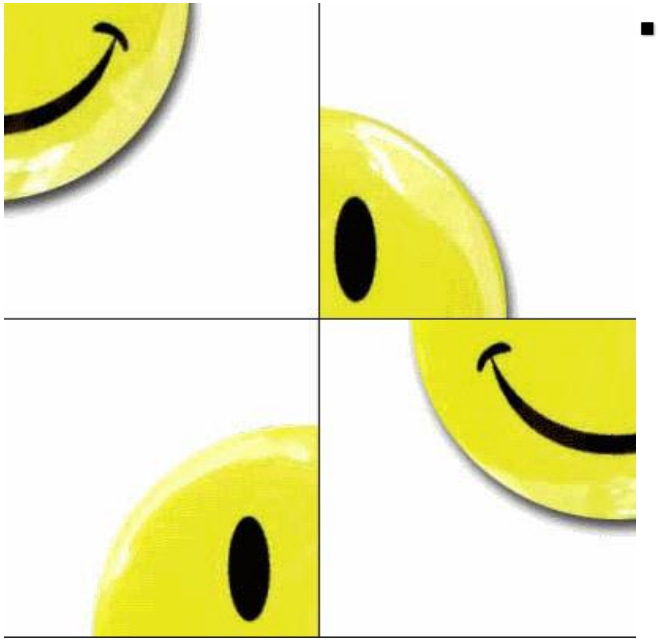
2 dimensional Square Puzzle of 2 x 2
24 possible combinations



- Cálculo do fatorial de 2*2=4
  - 4! = 4*3*2*1 = 24
  - O fatorial de 4 é igual a 24

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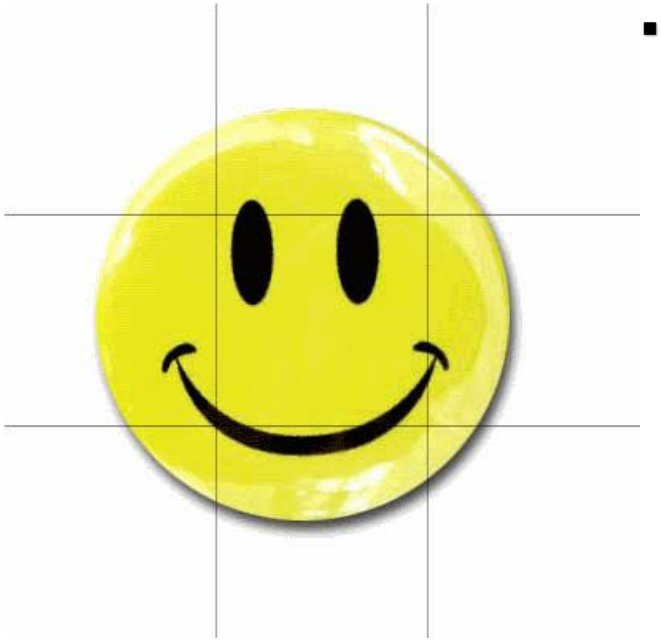
2 dimensional Square Puzzle of 3 x 3
362 880 possible combinations



- Cálculo do fatorial de 3*3=9
  - 9! = 9*8*7*6*5*4*3*2*1 = 362 880
  - O fatorial de 9 é igual a 362 880

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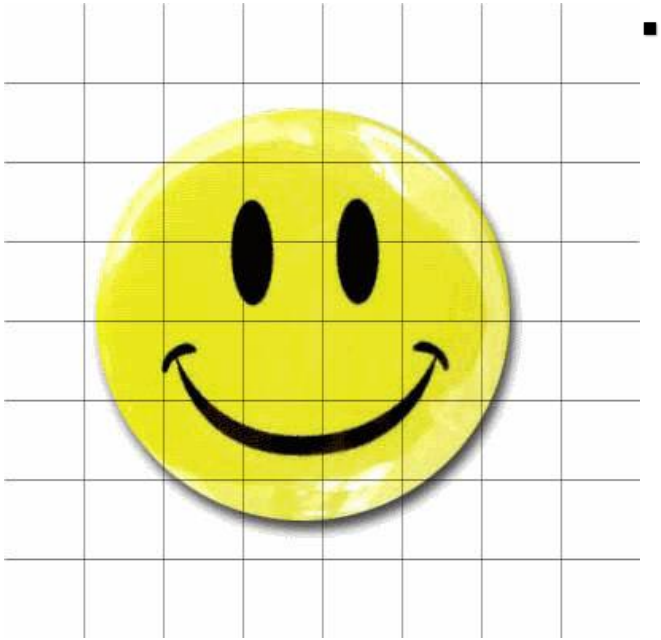
2 dimensional Square Puzzle of 8 x 8
≅ 1.2688 x 10^{89} possible combinations



- Cálculo do fatorial de 8*8=64:
  - 64! = 64*63*…*2*1 = 1.2688693218588E+89
  - O fatorial de 64 é igual a 1.2688693218588E+89.

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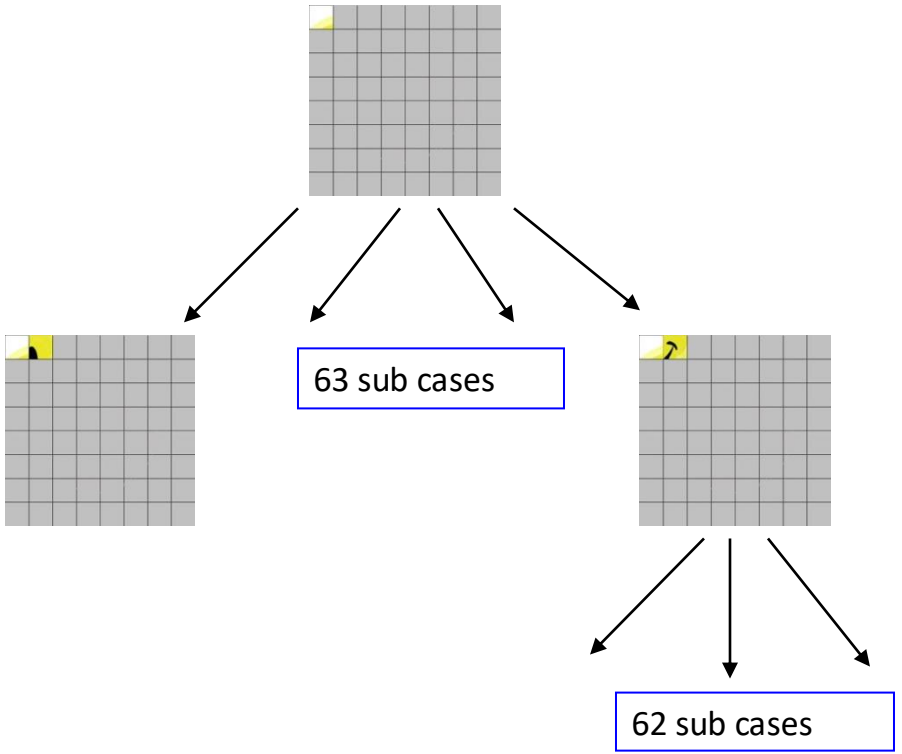
2 dimensional Square Puzzle of 8 x 8
≅ 1.2688 x 10^{89} possible combinations



The Problem

- $(8 \times 8)! \cong 1.2688 \times 10^{89}$ possible combinations.

- 1,000,000,000 of combinations per second would take 4 x 1,069 millennia to test all combinations !!!

The Problem

- But…
  why can humans solve the problem in a short time?

- The answer is simpler than we think:
  because we use knowledge about the problem intelligently.

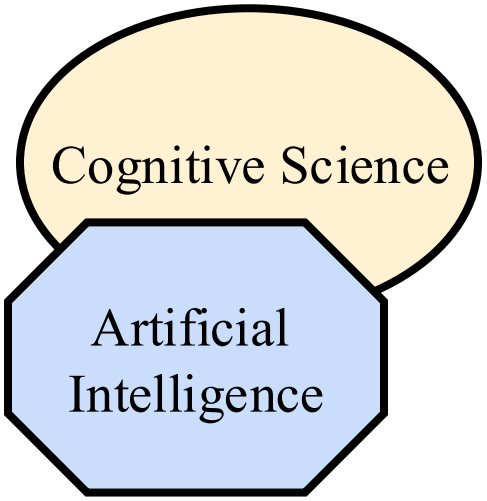
The Problem

- Can we program a computer to use knowledge of a problem intelligently?

- The answer is in **Artificial Intelligence**.

Cognitive science

- Perception and Action
- Memory, Attention and Consciousness
- Nuclear knowledge
- Categorization, Lexicon and Ontology
- Learning
- Language and Representation
- Choice, Rationality and Decision
- Culture and Social Cognition



AI = Study of intelligence as computing

AI - a source of knowledge

- It is one of 14 core areas of computer knowledge, according to the ACM Computing Curriculum.

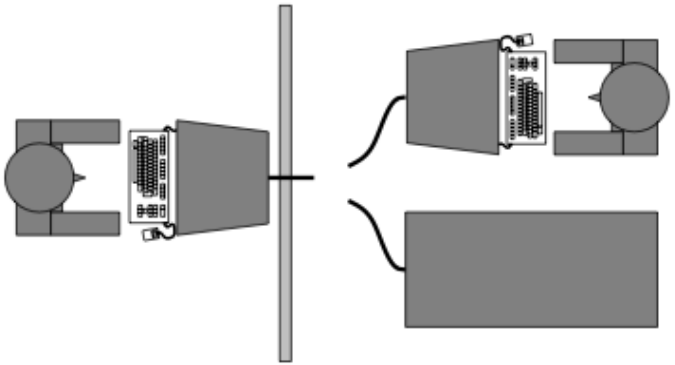
Alan Turing

- He worked with Kurt Gödel, Alonzo Church, and John von Neumann on the problem of decision, universal (Turing) machines, the breaking of the Enigma code, and the artificial brain.
- 1950: article “Computing Machinery and Intelligence ”and the Turing test.
- Program that plays chess (1953).

Beginnings - The Turing Test

- "In the next 50 years, we will be able to build computers that will be good at playing the imitation game that an average questioner has only 70% opportunity to correctly identify if he or she is a person or a machine."

in A. M. Turing "Computational Machinery and Intelligence", Mind, 1950.



The term Artificial Intelligence gained its meaning in 1956 at the Dartmouth Conference, when it was defined as:

"(Artificial Intelligence is) making a machine behave in ways that would be called intelligent if a human were so behaving."

John McCarthy.

What is Artificial Intelligence (AI)?

It is **the science and engineering of making** intelligent machines, especially **intelligent computer programs**. It is related to the similar task of using computers to understand human intelligence, but **AI** does **not** have to **confine** itself **to methods that are biologically observable**.

John McCarthy, 2003

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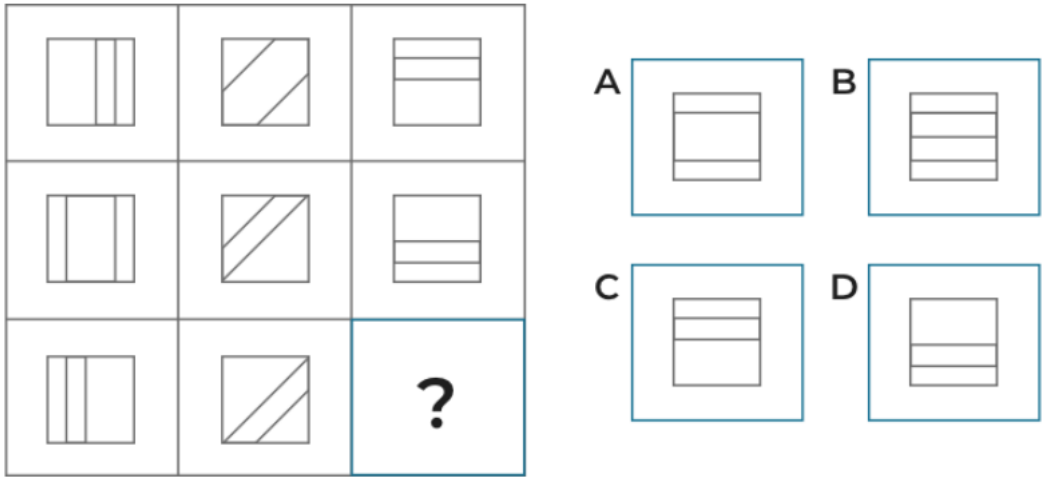

Source: https://www.assessment-training.com

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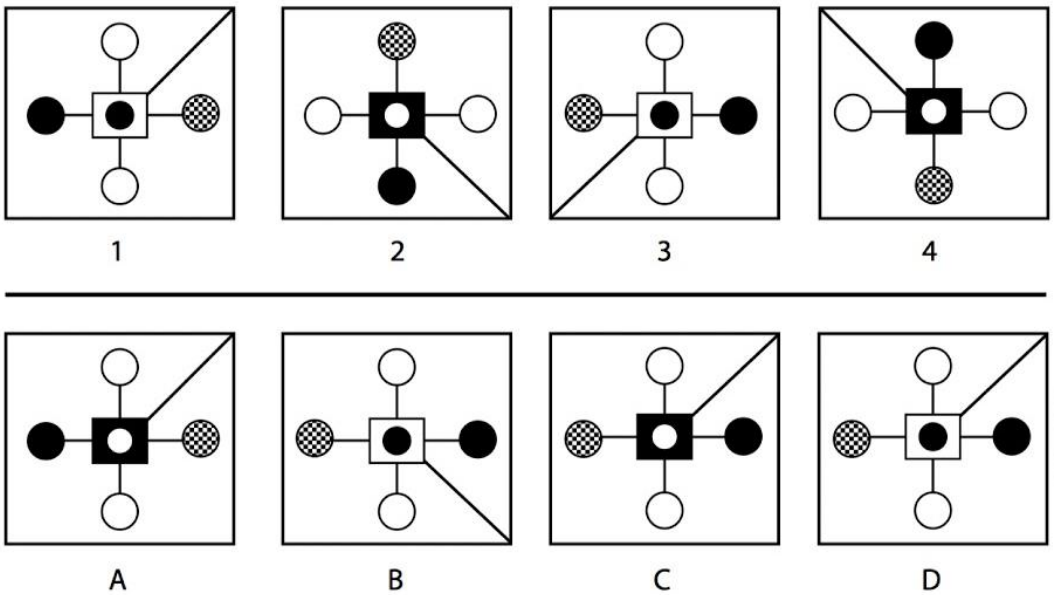

Source: https://www.youtube.com/watch?v=Ygi1HRgK4oM

Types of AI

- There are several different ways to categorize AI.
- One of the most used divides AI into two strands
  - Weak AI
  - Strong AI

Weak AI

- Weak AI or Narrow AI
- Includes systems designed and trained to solve very specific tasks.
  - Deep Blue - Won chess in 1996, Garry Kasparov. Is Deep Blue smarter than Garry Kasparov?

Weak AI

- Weak AI or Narrow AI
- Includes systems designed and trained to solve very specific tasks.
  - Dendi vs. IA - Bot IA beats Dendi, DOTA 2. AI more inteligence than Dendi?

Danil "**Dendi**" Ishutin is a professional Dota 2 player on Natus Vincere. Well known for his solo mid skills, he is regarded as one of the most creative players in the scene today, and is renowned for his unorthodox play style and unconventional skill and item builds

Weak AI

- Weak AI or Narrow AI
- Includes systems designed and trained to solve very specific tasks.
  - DeepMind (Google) learns to run

Weak AI

- Weak AI or Narrow AI
- Includes systems designed and trained to solve very specific tasks.
  - Siri - personal assistant who answers questions through a natural language interface. Fits the user with use

Strong AI

- Known as General Artificial Intelligence (General AI);
- System that works at the level of a Human, in the sense that it will be able to feel, have the same sensory perception, be aware, etc…
- It is not expected to be programmed for it, it is expected to learn and evolve over time;
- Will be able to solve any problem.

Main challenge

- "Strong AI's ultimate goal is to make an intelligent computer that can think and understand"
  - What is thinking?
  - How do we think?
  - What does it mean to realize something?
  - How do we perceive?
  - What is being smart?

- If we can't define / understand these concepts
  - How are we going to use them?
  - How do we measure success?
  - How will we recognize intelligence / thinking / recognition / awareness?

Over 50 years of history

~ 3000 BC - In Egypt, a papyrus was written associating observation of symptoms with diagnoses and their treatments in the human head. The observations resemble IF-THEN rules, common in today's Expert Systems.

~ 450 BC - Plato states that all knowledge can be established through explicit definitions, which could later be applied.

~ 322 BC - After Aristotle's death, his disciples compile the first systematic treatments on logic (Organon).

10th Century: Pope Silvester II, legend has it that had a machine that answered questions.

13th Century

Ramón Lull invents Ars Magna from the idea of Zairja, the first mechanical device that tries to generate ideas.

Over 50 years of history

17th Century

Leviathan is published by Thomas Hobbes, where it is suggested that humans through their organizations or machines could create new intelligence (1651).

At only 19, Blaise Pascal invented Pascaline, an 8-digit mechanical calculator (1642).

Blaise Pascal does work on probabilistic calculus (1654).

The Leibnitz Mechanical Computer appears, which makes a multiplication by successive additions.

Over 50 years of history

- **18th and 19th century**

A book with Thomas Bayes's theory of conditioned probability reasoning (1763) is published posthumously.

Charles Babbage designs his programmable mechanical computer (1832).

George Boole develops Symbolic Logic, Boole Algebra (1847).

English naturalists Charles Darwin and Alfred Wallace set out their theory of species evolution on the basis of natural selection (1858).

Over 50 years of history

- Still 19th Century

  Augustus De Morgan proposes a systematic treatment of logical relations (1864).

  Gottlob Frege creates the Predicate Logic (1879).

  The first manual mechanical calculators (1890) began to appear on the market.

  Herman Hollerith patents a machine that processes census data stored on punched cards. His company, Tabulating Machine Company, originated with IBM (1890).

  In the late 19th century Leonardo Torres y Quevedo invented a relay-based electric automaton that plays chess.

Over 50 years of history

- **20TH CENTURY**

1913 - Andrei Markov works on sequence analysis in texts.

1915 - Leopold Lowenheim performs the systematic treatment of Model Theory in Logic.

1926 - The fiction movie Metropolis appears with the robot Maria.

1928 - John von Neumann introduces the Minimax method, used by gaming programs.

1931 - Kurt Godel presents the Incompleteness Theorem.

1937 - Alan Turing designs the Universal Turing Machine.

1937 - Alan Turing and Alonzo Church independently propose that every problem a human being solves can be reduced to a set of algorithms.

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Over 50 years of history

1939 Isaac Asimov writes the book "I Robot" and introduces the term Robotics.

1940 - The Robinson relay computer is used by the English to decode the messages from the German Enigma coding machine.

1945 - John Von Neumann designs the basic architecture of computers.

1945 - John Maucheley and John Presper Eckert create the Electronic Numerical Integrator and Calculator (ENIAC), the first general-purpose programmable computer.

1949 - Claude Shannon proposes Information Theory.

1950 Alan Turing proposes the Turing Test.

1951 - Marvin Minsky and Dean Edmonds build the first artificial neuronal network that simulates a mouse finding a way through a maze.

1956 - Darthmouth College meeting takes place.

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10 AI Pioneers, 1956

- John McCarthy
- Marvin Minsky
- Ray Solomonoff
- Oliver Selfridge
- Claude Shannon
- Nathaniel Rochester
- Trenchard More
- Arthur Samuel
- Allen Newell
- Herbert Simon

John McCarthy

- Main proponent of the Dartmouth Summer Research Project on Artificial Intelligence;
- Author of the term “Artificial Intelligence”;
- Creator of the LISP programming language in 1958.

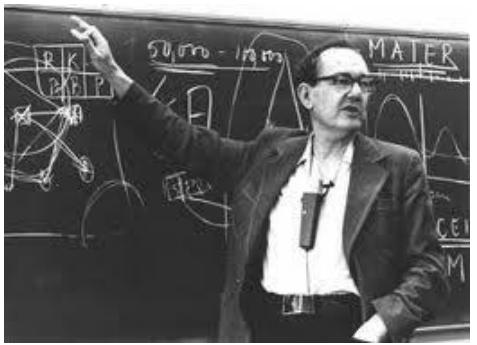
Marvin Minsky

- In 1951 he built SNARC, the first simulator of a Neuronal Network;
- Develops the Blocks Microworld Project in 1967;
- MIT co-founder;
- Consultant for the 2001 Space Odyssey where the HAL9000.

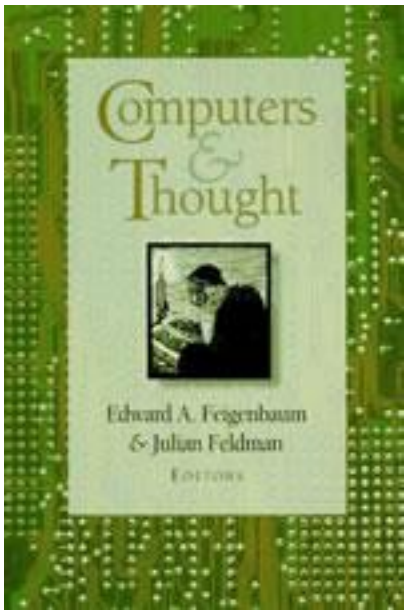
Photograph: Alamy

Herbert Simon

- Participated in the Dartmouth Summer Research Project on Artificial Intelligence;
- Created, along with Allen Newell, the Logic Theory Machine and the General Problem Solver system;
- He received the Nobel Prize for Economics for his work in the area of Decision Making in Economic Organizations.



- Computers and Thought
  Edited by Edward A. Feigenbaum and Julian Feldman
  1963



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Dartmouth, 50 years later

THE DARTMOUTH	Commemorating
ARTIFICIAL INTELLIGENCE	the 1956 founding
CONFERENCE:	at Dartmouth College
THE NEXT FIFTY YEARS	of AI as a research discipline

50th Anniversary Summit of Artificial Intelligence

Centro Stefano Franscini - Monte Verita - Switzerland
9-14 July 2006

Research Laboratories

- MIT AI Lab
- Stanford AI Lab
- CMU Robotics Lab
- Berkeley Robotics and Intelligent Machines Lab
- Edinburgh Department of AI (School of Informatics e AIAI)
- …
- Google, Facebook, Amazon, etc
- Portugal: GIA-UMinho, CENTRIA, LIACC, LabMAg, GECAD, …

- Symbolic: Psychology.
- Connectionist: Neurosciences.
- Reactive Robotics: Control Theory.
- Artificial Life: Biology.
- Social: Sociology, Economics.

- Symbolic: Linguistic Metaphor

  e.g.: Expert systems, agents, ...
- Connectionist: brain metaphor

  e.g.: Neural Networks.
- Evolutionist: Metaphor of Nature

  e.g.: Genetic algorithms, artificial life.
- Statistical / Probabilistic / Posibilistic:

  eg Bayesian networks, diffuse systems.

AI Awards

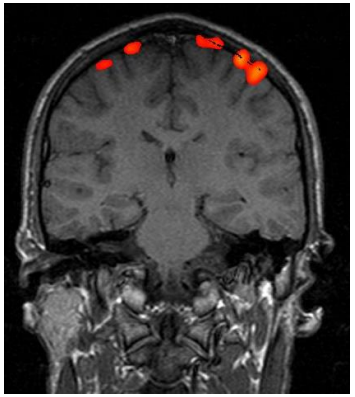
- Nobel: Lederberg (Chemistry - 1958), Simon (Economy - 1978).
- Medalha Benjamin Franklin 2003: John McCarthy
- ACM Turing: Minsky (1969), McCarthy (1971), Newell e Simon (1975), Sutherland (1988), Feigenbaum (1994), Kay (2003).
- IJCAI: Geoffrey E. Hinton (2005), Raj Reddy (2005)
- Loebner: Rollo Carpenter with “Jabberwacky” (2005)
- DARPA: Sebastian Thrun and Stanley (2005).
- Allen Newell: Jack Minker (2005).
- Software System: Robert S. Boyer, Matt Kauffman and S. Strother Moore (2005).
- MacArthur Genius Grant 2004: Daphne Koller.
- Chess 1997: Deep Blue II (IBM)

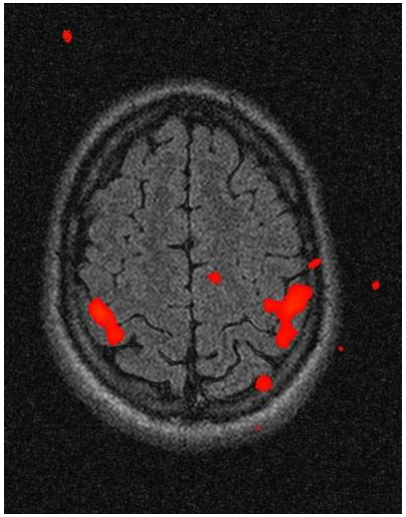
Applications of Artificial Intelligence

- How to predict the value of the Euro (or climate)?
- Which data is the most relevant?
- Can there be recurring behaviors?

Computer vision:

Computer vision systems are widely used in both industry and medicine.

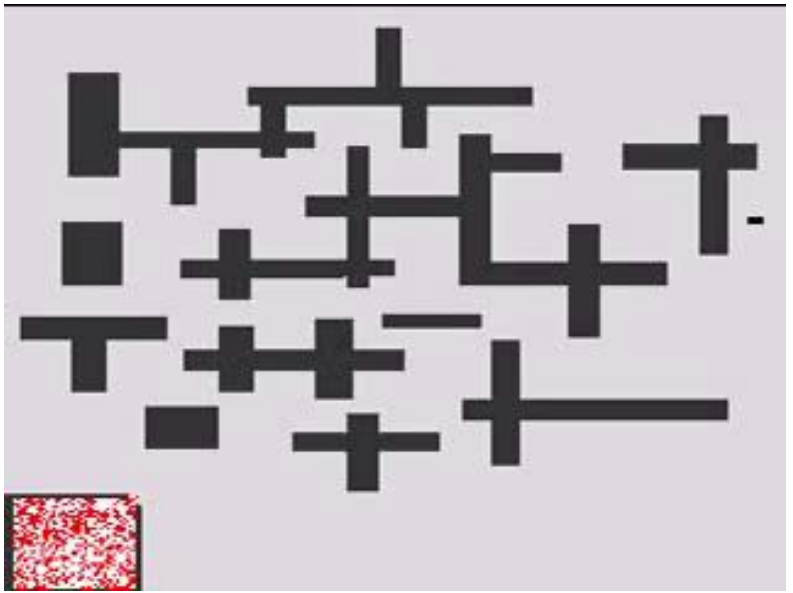




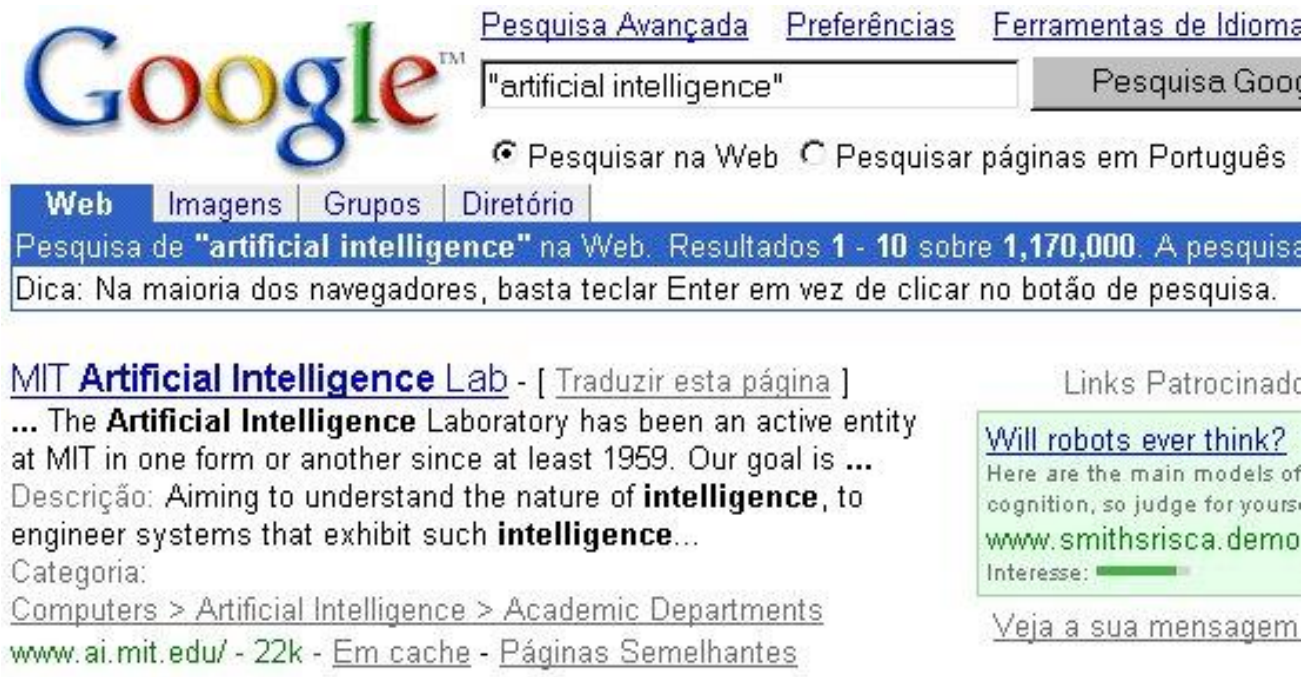
Applications of Artificial Intelligence

Optimization

Use of Genetic and Evolutionary Computing or Group Intelligence techniques to search for “possible” solutions rather than optimal solutions.



How to locate the relevant information?



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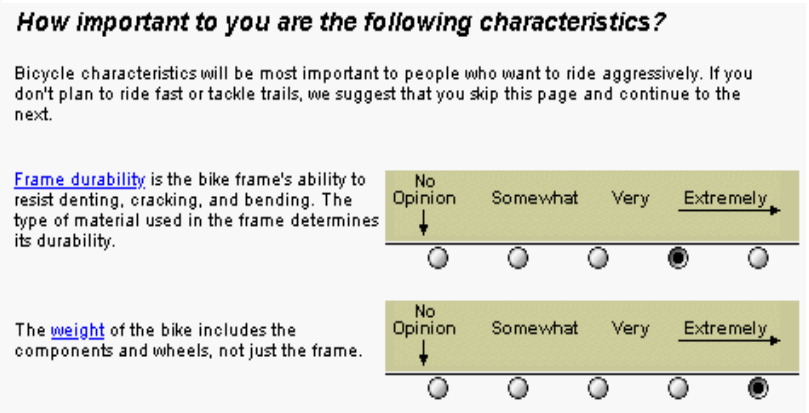
Product Recommendation

- How to make personalized product recommendations?
- How to model the profile of buyers?



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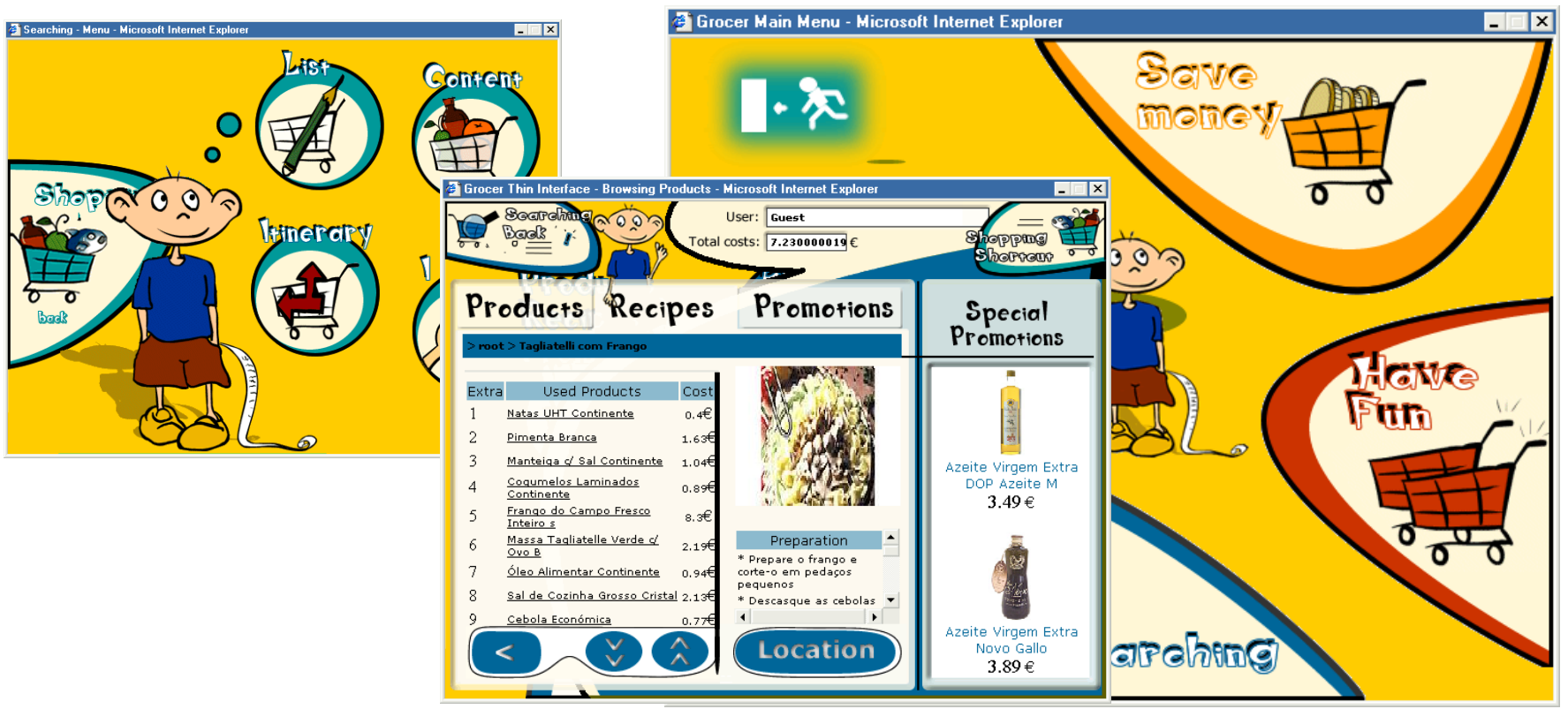
e-Commerce



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Personal Assistant in Automatic Transactions

Source: MIT

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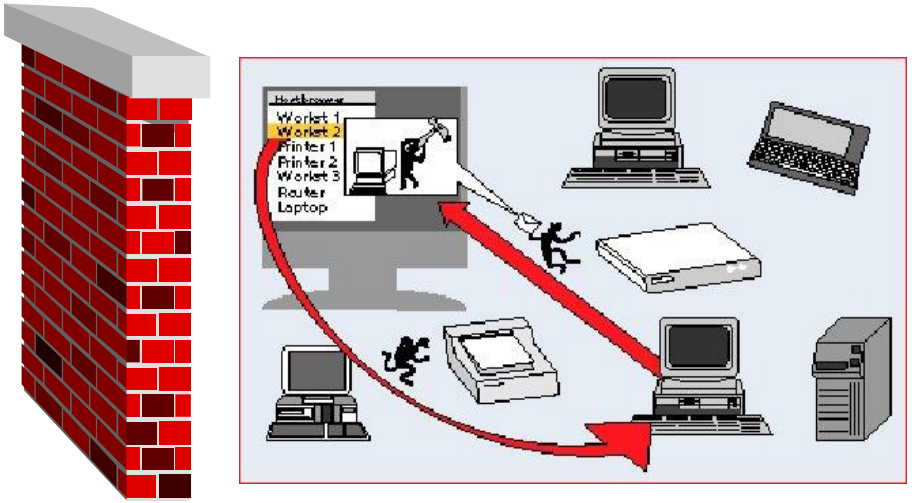
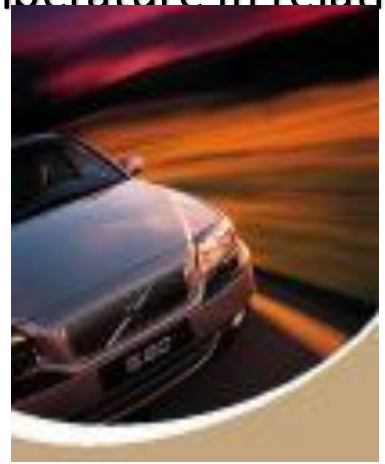
Intrusion Detection and Spam Filtering

- How to tell if a message is junk or in fact matters?
- How to tell if user behavior is suspicious and how to deal with it?



Control system

- How to brake the car without the wheels sliding depending on speed, friction, etc.?
- How to focus the camera according to brightness, distance, etc.?
- How to adjust the temperature in relation to the amount of clothes, water flow, etc.?

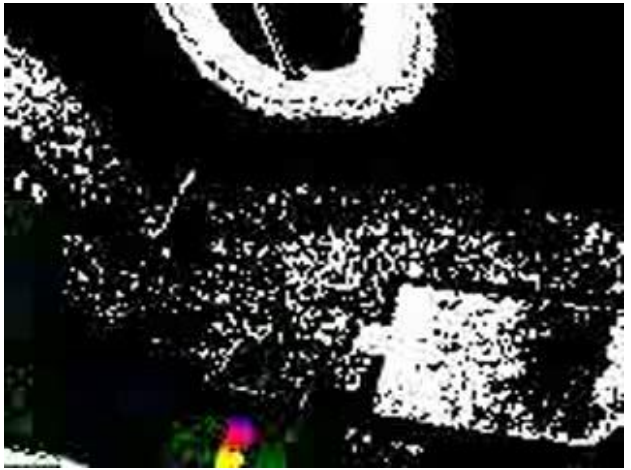


Intelligent interfaces

- How to provide the user with the help he needs?
- How to interact (and maybe surf the web)?

Computer Vision:

Vision as a sensor of the environment.

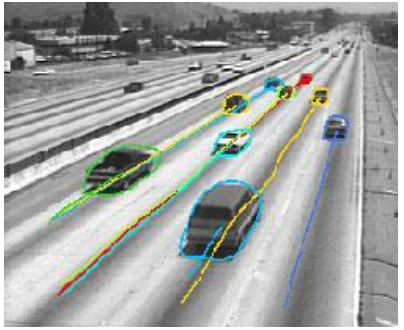


Robots and Intelligent Surveillance

- Robots for playing soccer (RoboSoccer):




- Intelligent, real-time surveillance of urban traffic (cities and highways):



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Google Self-Driving Car Project

- Car (Electric) self-developed by Google;
- Google Chauffeur Software;

- This project was previously led by Sebastian Thrun, former director of the Intelligence Laboratory of Stanford Artificial and Google Street View co-inventor.

Google Self-Driving Car Project

DARPA Robot Race 2005

Autonomous vehicles along 212 km of the Nevada desert: Stanley winner against CMU.

Sebastian Thrun of Stanford University beat the 3 teams from CMU, which had in turn beat MIT Rodney Brooks at the NASA Mars Mission Contest (STANLEY, 2005).

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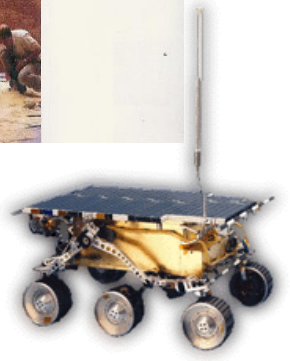
Space Exploration



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Collaborative e-Marketplaces
(http://www.mfgquote.com)

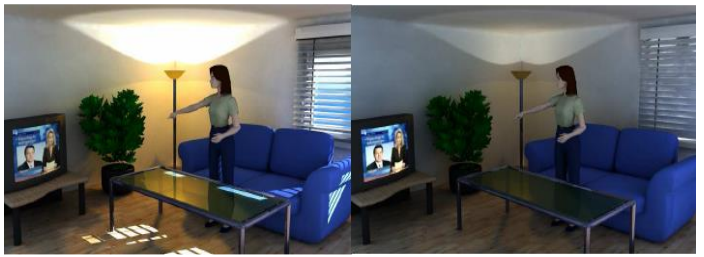
AmI (Ambient Intelligence)

Microsoft Home TV Commercial

AmI: Applications

At Home

- EMBASSI: Context Awareness



- Philips HomeLab, entertainment at WC mirror

AmI: Applications

Tourism and Culture

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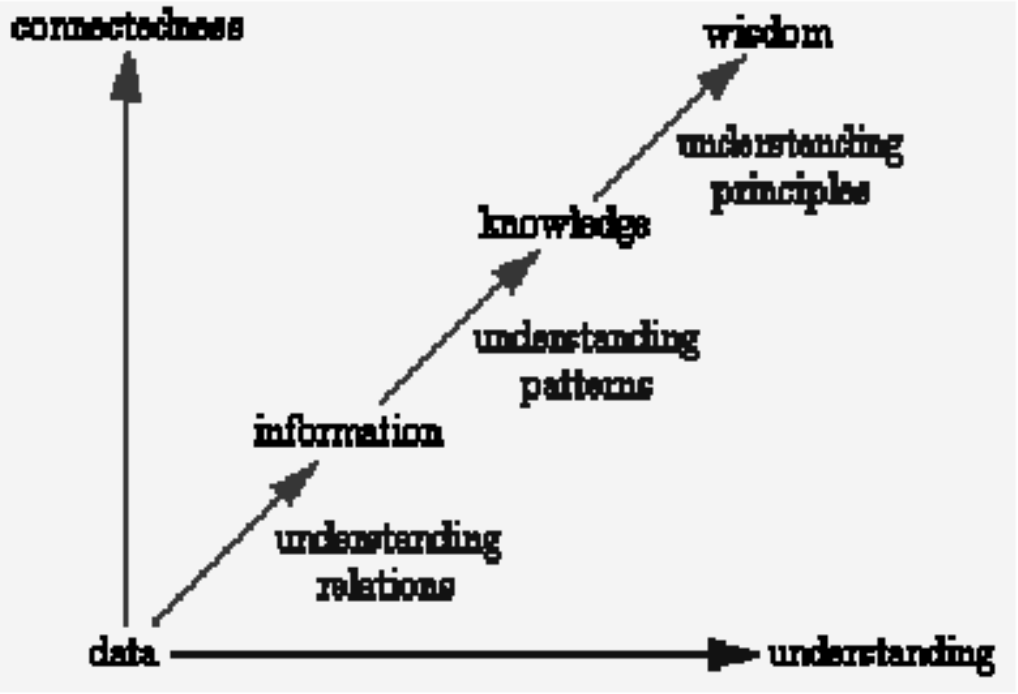
What do these problems have in common?

- Great complexity (number, variety and nature of tasks);
- There is no “algorithmic solution”, but there is knowledge;
- Intelligent behavior modeling (knowledge, learning, initiative, etc.).

Wisdom



Kulsch, 2001

Books that make history

(Feigenbaum and Feldman, 1963) Computers and Thought
(Minsky, 1968) Semantic Information Processing
(Michie, 1968) Machine Intelligence 3
(Banerji, 1969) Theory of Problem Solving
(Simon, 1969) The Sciences of the Artificial
(Minsky and Papert, 1969) Perceptrons
(Nilsson, 1971) Problem-Soving Methods in AI
(Winograd, 1972) Understanding NL
(Minsky, 1972) Computation, Finite and Infinite Machines
(Newell and Simon, 1972) Human Problem Solving
(Michie, 1974) On Machine Intelligence

Books that make history

(Coelho, Moniz Pereira anf Cotta, 1979) “How to solve it with PROLOG”.

(Nilsson, 1980) Principles of AI

(Winston, 1984) Artificial Intelligence

(Minsky, 1986) The Society of Mind

(Genesereth and Nilsson, 1987) Logical Foundations of AI

(Coelho and Cotta, 1988) Prolog by Example, How to Learn, Teach and Use it

(Newell, 1990) Unified Theories of Cognition

(Rich e Knight, 1991) Artificial Intelligence

(Ginsberg, 1993) Essentials of AI

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Books that make history

(Russell and Norvig, 1995) AI A Modern Approach
(Dean, Allen and Aloimonos, 1995) AI Theory and Practice
(McCarthy, 1996) Defending AI Research
(Mitchell, 1997) Machine Intelligence
(Nilsson, 1998) AI: A New Synthesis
(McDermott, 2001) Mind and Mechanism
(Baum, 2004) What is Thought?
(Pedro Domingos, 2015) The Master Algorithm
(Nick Bostrom,2017) Superintelligence: Paths, Dangers, Strategies
(Arlindo Oliveira, 2018) The Digital Mind: How Science Is Redefining Humanity
(Max Tegmark, 2018) Life 3.0: Being Human in the Age of Artificial Intelligence
(Stuart Russel, 2019) Human Compatible : AI and the Problem of Control
(Marcus and Davis, 2019) Rebooting AI: Building Artificial Intelligence We Can Trust

After an AI Winter

- AI (improves / improves) as people use it.
- It is us?
- When we look at AI we see not a single program, but an aggregation of several software and multiple agents.

Goal:

- Helping humans to think and act smarter.

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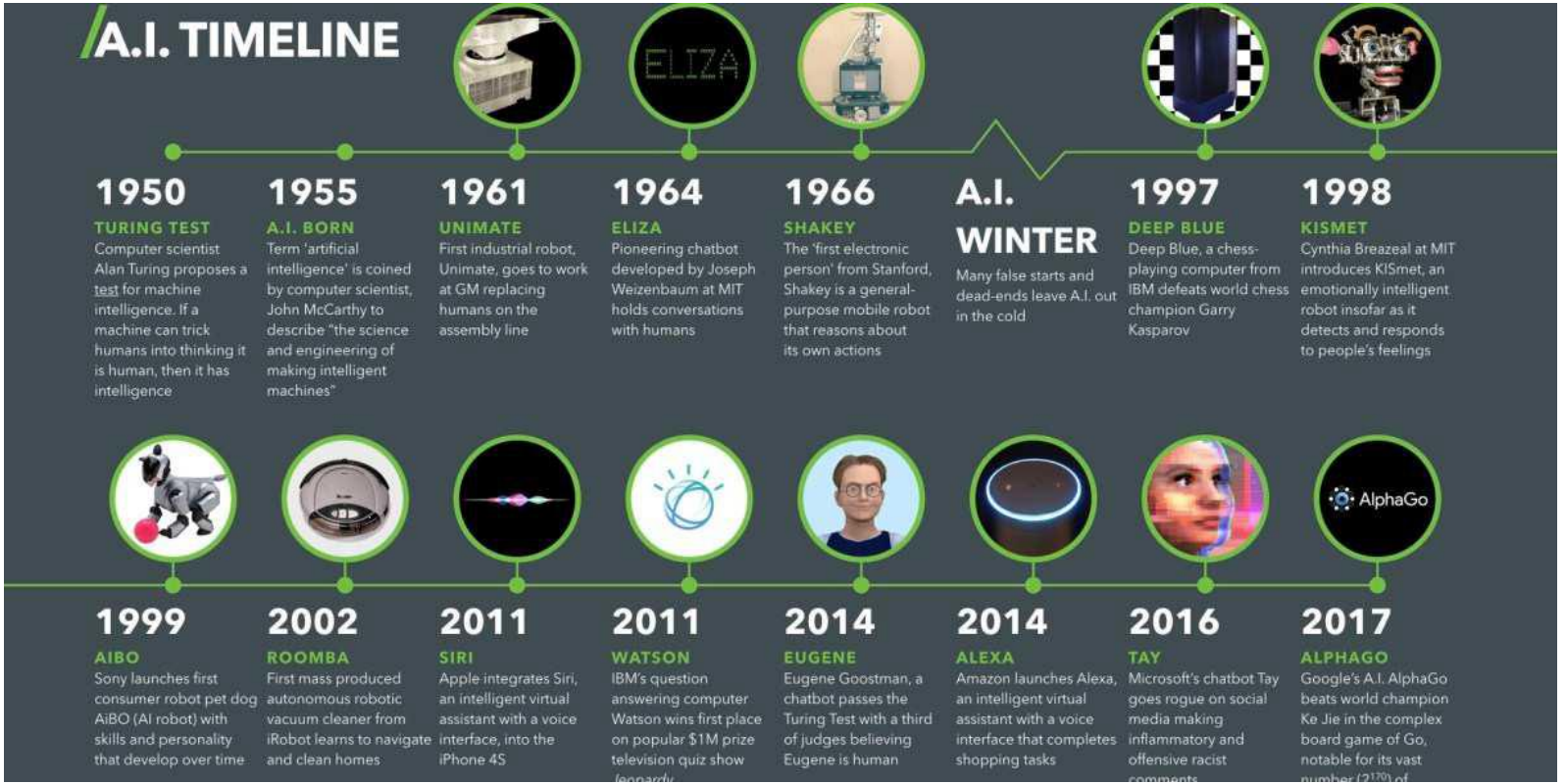
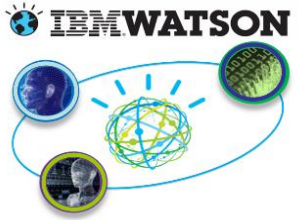
AI Timeline



Source: Paul Marsden
https://digitalwellbeing.org/artificial-intelligence-timeline-infographic-from-eliza-to-tay-and-beyond/

Watson (IBM)

- In February 2011, Watson beat the two best players in the USA program TV Jeopardy (Brad Rutter and Ken Jennings);
- Watson represents an important step in the development of cognitive systems.
- It use Natural language processing, generation and evaluation of hypotheses and learning.
- Deep QA



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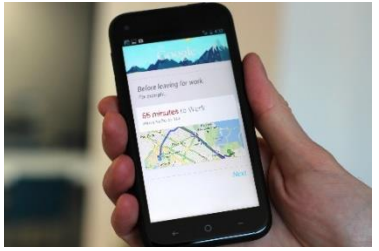
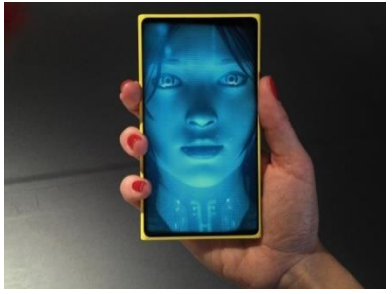
A new beginning

- The AI returned for good (at least until further disappointment…)
- AlphaGo (Google) Wins Go World Champion, Not using brute force (Impossible) but using Strategy/Complexity Reduction
- Algorithm paints a Rembrandt
- WaveNet (Google) able to create speech with different accents and music
- Facebook, Amazon, Google, IBM and Microsoft Create AI Partnership
- Drone captures other drones autonomously
- Google's translation tool "accidentally" invents a language of its own in Korean <-> Japanese translation
- OpenAI (Elon Musk) makes Universe available
- …

Personal Digital Assistants

- Siri (Apple iPhone);
- Messenger (Facebook);
- Google Now (Google);
- Cortana (Windows Phone, Microsoft).

Next trends

- Personal photo archivist;
- Self driving car (Toyota brevemente);
- Universal translator (Skype);
- Body tracker (Microsoft Xbox Kinect tv);
- Smarter news feed (voice and image recognition software).

New living environments

"In the years ahead, further exciting innovations will unify the software, hardware and services in people's lives, offering them even richer, more engaging and deeply connected experiences."

Bill Gates, Outlines Vision for the Digital Lifestyle (2006)

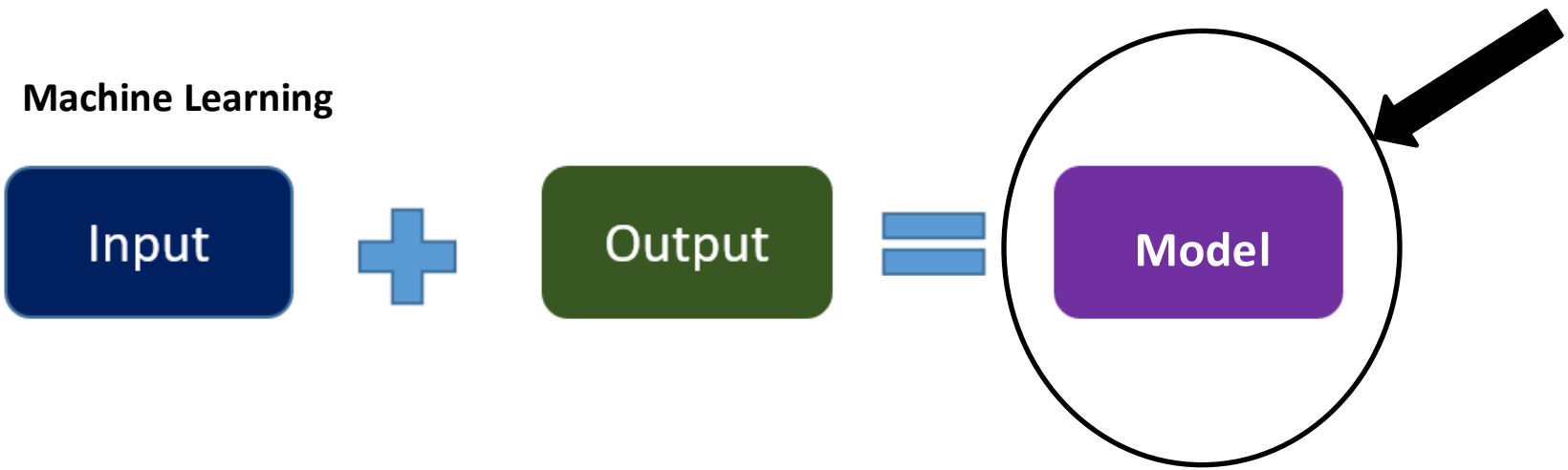
Challenges

- From intelligence to instinct and intuition;
- Citizen empowerment (como mecanismo de inclusão);
- Contactless services;
- Smart mobility;
- Smart cities and transports;
- Cyber security and identity.

Our moment

Programming

Machine Learning



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Deduction *vs* Induction

Deduction		Induction	
All humans are mortal.	(Axiom)	Socrates is human.	(Background K.)
Socrates is human.	(Fact)	Socrates is mortal.	(Observation(s))
Conclusion:		*Generalization:*	
Socrates is mortal.		All humans are mortal.	

Deduction: from general to specific ⇒ **proven** correctness

Induction: from specific to general ⇒ (**unproven**) knowledge gain

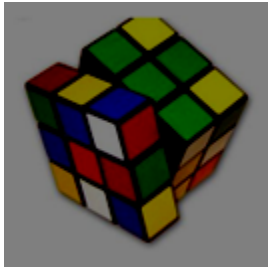
Induction generates hypotheses not knowledge!

Source: Lecture 1: Basic Concepts of Machine Learning
Cognitive Systems - Machine Learning
Ute Schmid and Johannes Rabold
Applied Computer Science, Bamberg University, 2017

Model-Dirven

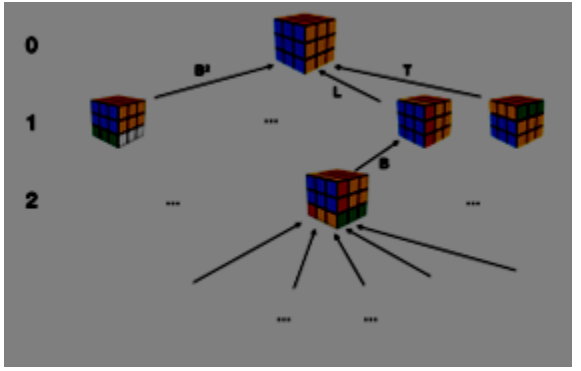
- Initial state

- change state with an action



- goal (Final state)

- state space



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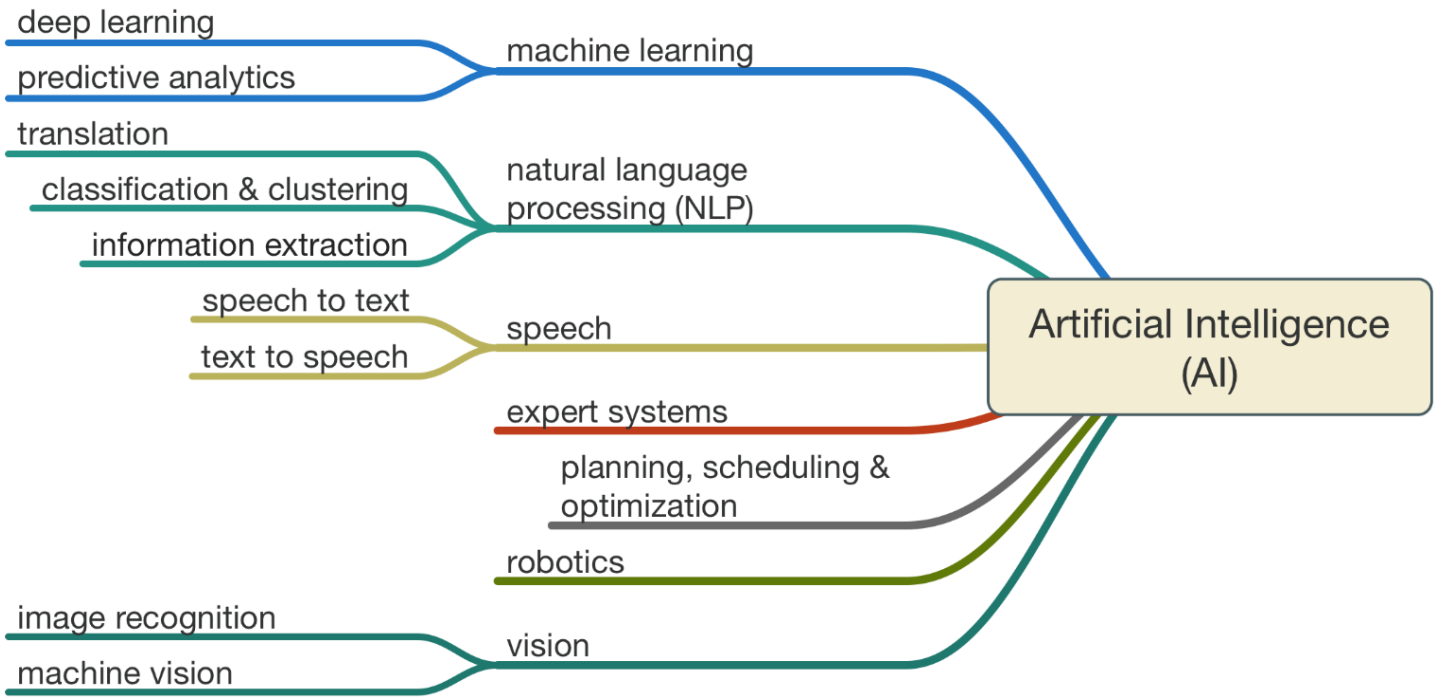
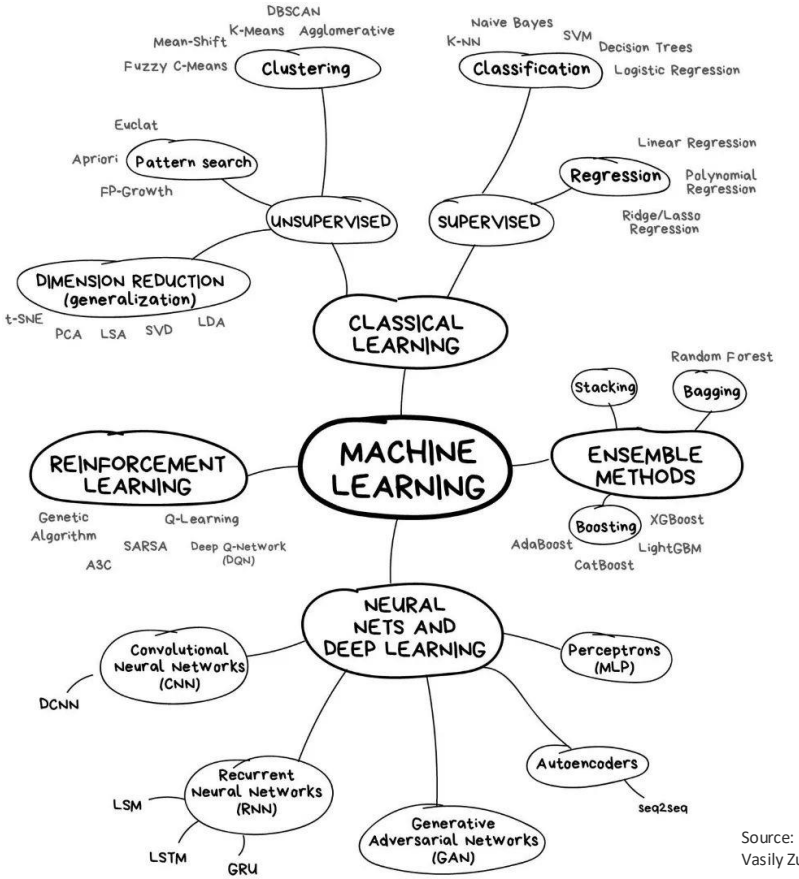
AI: Fields



Source: Fields of artificial intelligence
Mills, M."ARTIFICIAL INTELLIGENCE IN LAW:THE STATE OF PLAY"
http://bloghs.neotalogic.com/state-of-play.

Machine Learning



Source: The map of the machine learning world
Vasily Zubarev (vas3k.com)

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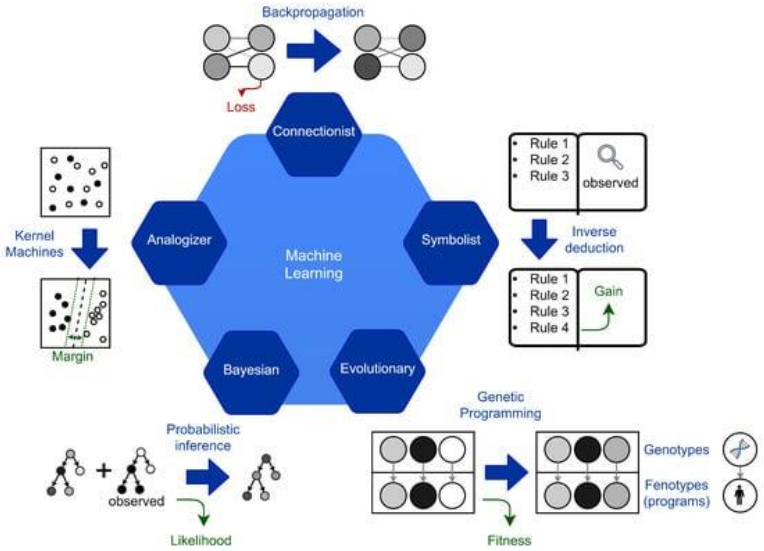
Data-Driven



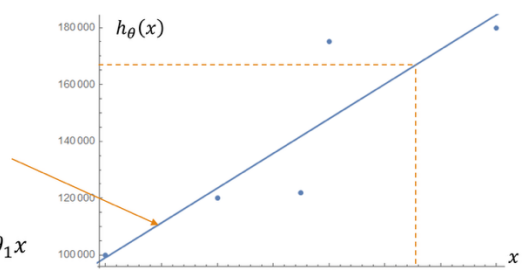
Source: Vaccaro, L.; Sansonetti, G.; Micarelli, A. An Empirical Review of Automated Machine Learning. Computers 2021, 10, 11. https://doi.org/10.3390/computers10010011

House prices by area

Area	Price
120	175000
150	180000
80	100000
100	120000
115	122000

Function that models the problem h

$h_\theta(x) = \theta_0 + \theta_1 x$



Pedro Domingos
The 5 Tribes of the Machine Learning

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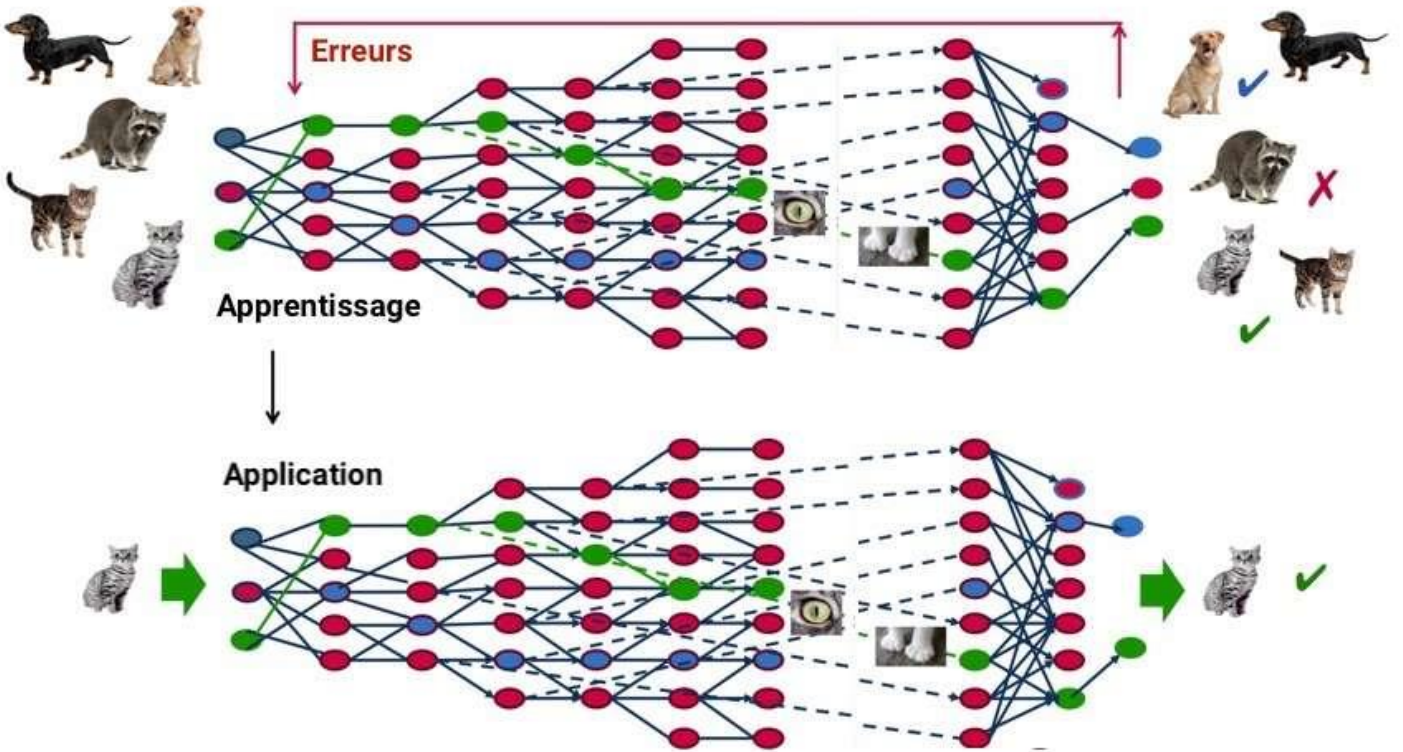
The issue of the moment: Deep(Deep(Depp)) Learning



Source:
https://www.futura-sciences.com/tech/definitions/intelligence-artificielle-deep-learning-17262/

DL applies a multi-layer process for learning rich hierarchical features (i.e., data representations)

- Input image pixels → Edges → Textures → Parts → Objects

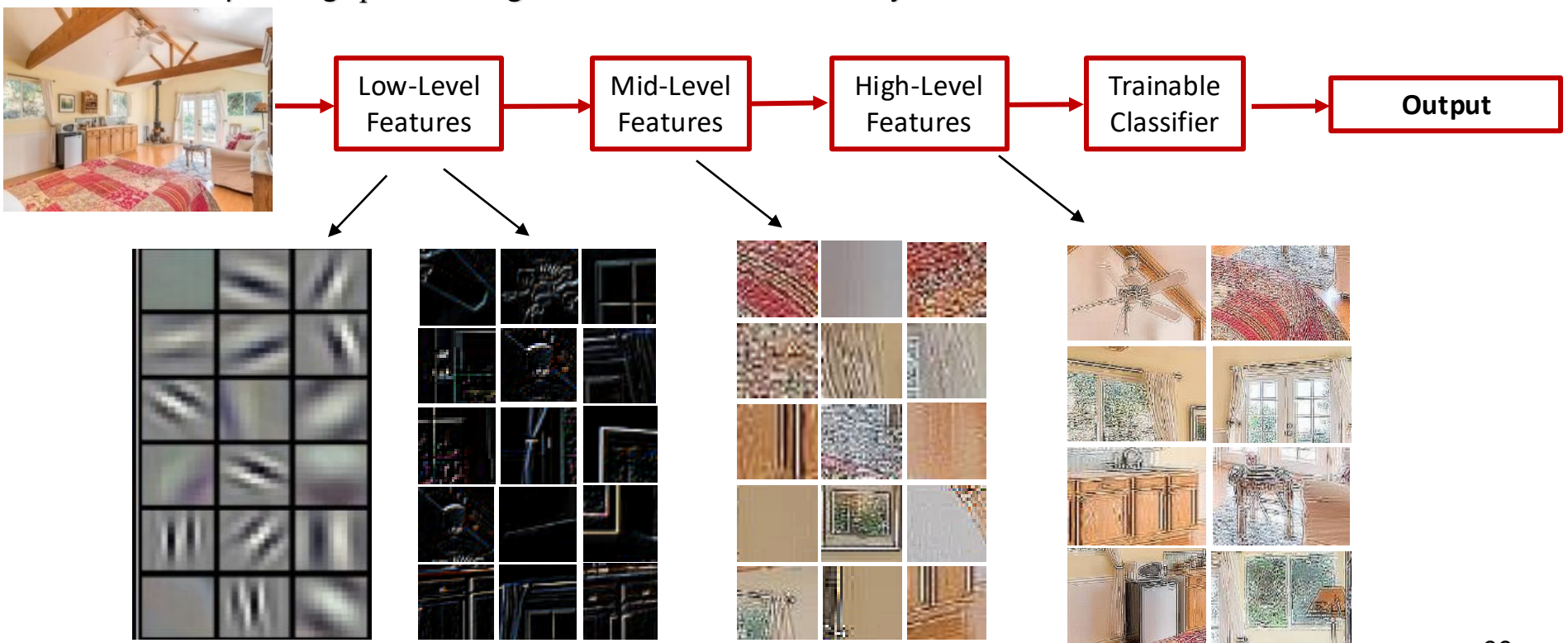


Image Source: Param Vir Singh – Deep Learning

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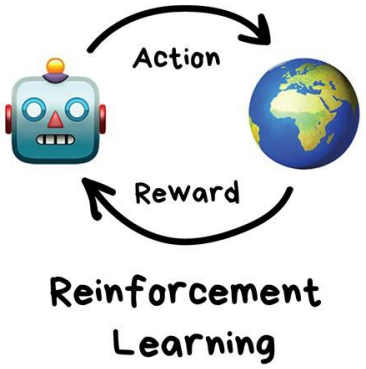
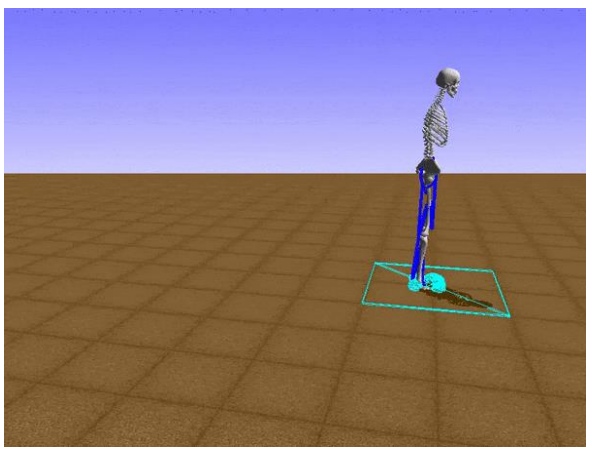
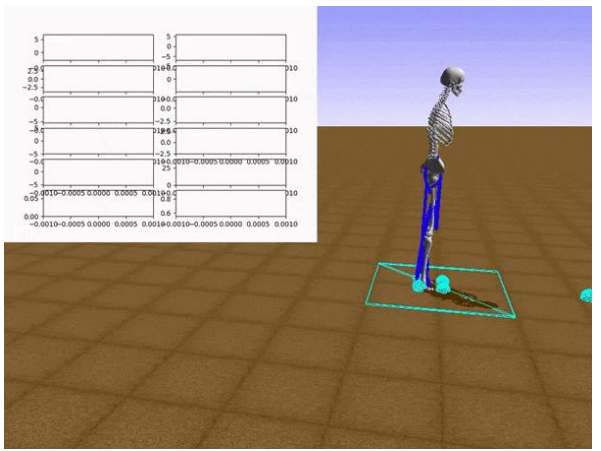
Reinforcement Learning



Source: Machine Learning for Everyone
https://vas3k.com/blog/machine_learning/





Source: Learning to run – an example of reinforcement learning
https://deepsense.ai/learning-to-run-an-example-of-reinforcement-learning/

Invent the (im)possible?

- **General AI**
  - A (intelligent) machine with the capacity to understand, learn and perform any human intellectual task;
  - Intuition, instinct, consciousness, self-awareness, sentience, sapience, self-determination, etc.
- **Most of the existing AI tech work differently than human intelligence;**

"the development of full artificial intelligence could spell the end of the human race"
Stephen Hawking

The creation of super intelligence as "summoning the demon"
Elon Musk

Source: Samuel Zeller on unsplash

OpenAI (Microsoft and Elon Musks) receives 1$ Billion USD funding to create AI that replicates the human brain (GAI), 2019.

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Suddenly, the world has changed ChatGPT

Source: The History Of Chatbots – From ELIZA to ChatGPT
https://onlim.com/en/the-history-of-chatbots/

"ChatGPT is a large language model trained by OpenAI (OpenAI,2021).
It is designed to assist users in generating human-like text based on given input. ChatGPT can be used for a variety of tasks, including conversation generation and language translation.
The model is trained on a massive amount of data, allowing it to generate text that is often difficult to distinguish from text written by a human. ChatGPT has been praised for its ability to generate natural-sounding text and its potential applications in a variety of fields.

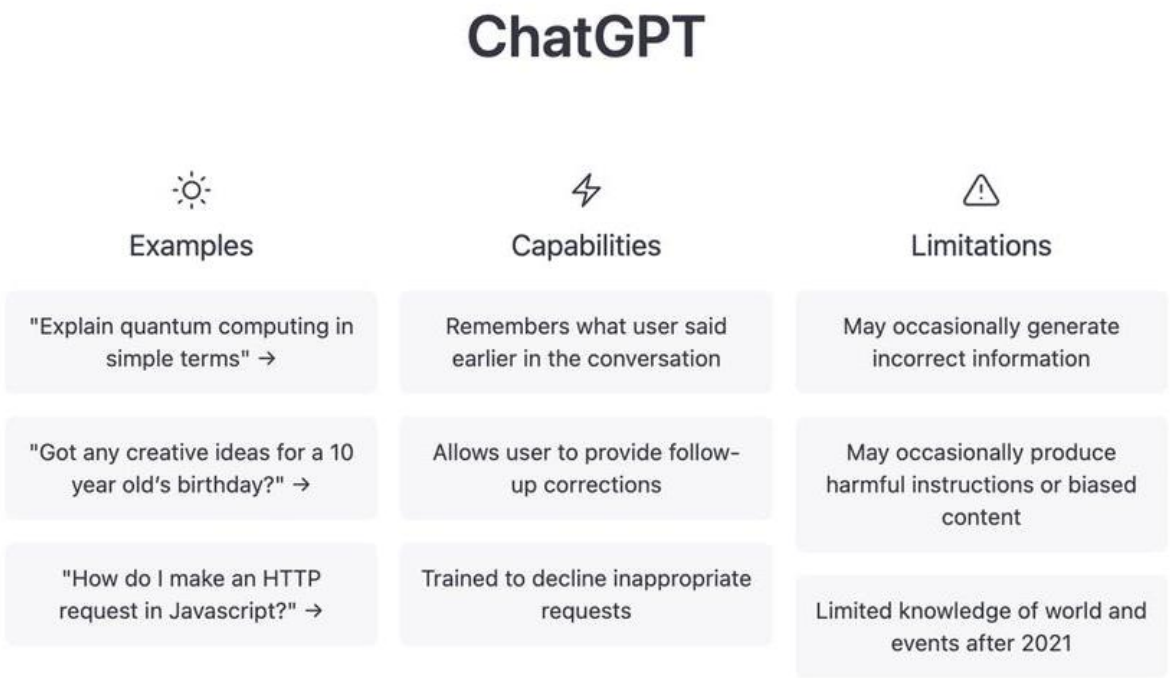
By the way – this abstract was created by ChatGPT."

Generative AI

- **Generative AI** is a type of AI technology that can produce various types of content, including text, images, audio and synthetic data;
- It does this by **learning patterns** from existing data, and then using this knowledge to generate new and unique outputs in response to prompts;
- Output: highly realistic and complex content that **mimics human creativity**;
- Using **Large language models** (LLM) are language models consisting of a very large neural network with billions of weights, trained on very large quantities of unlabelled text using self-supervised learning.

Source:What is generative AI? Everything you need to know, https://www.techtarget.com/searchenterpriseai/definition/generative-AI

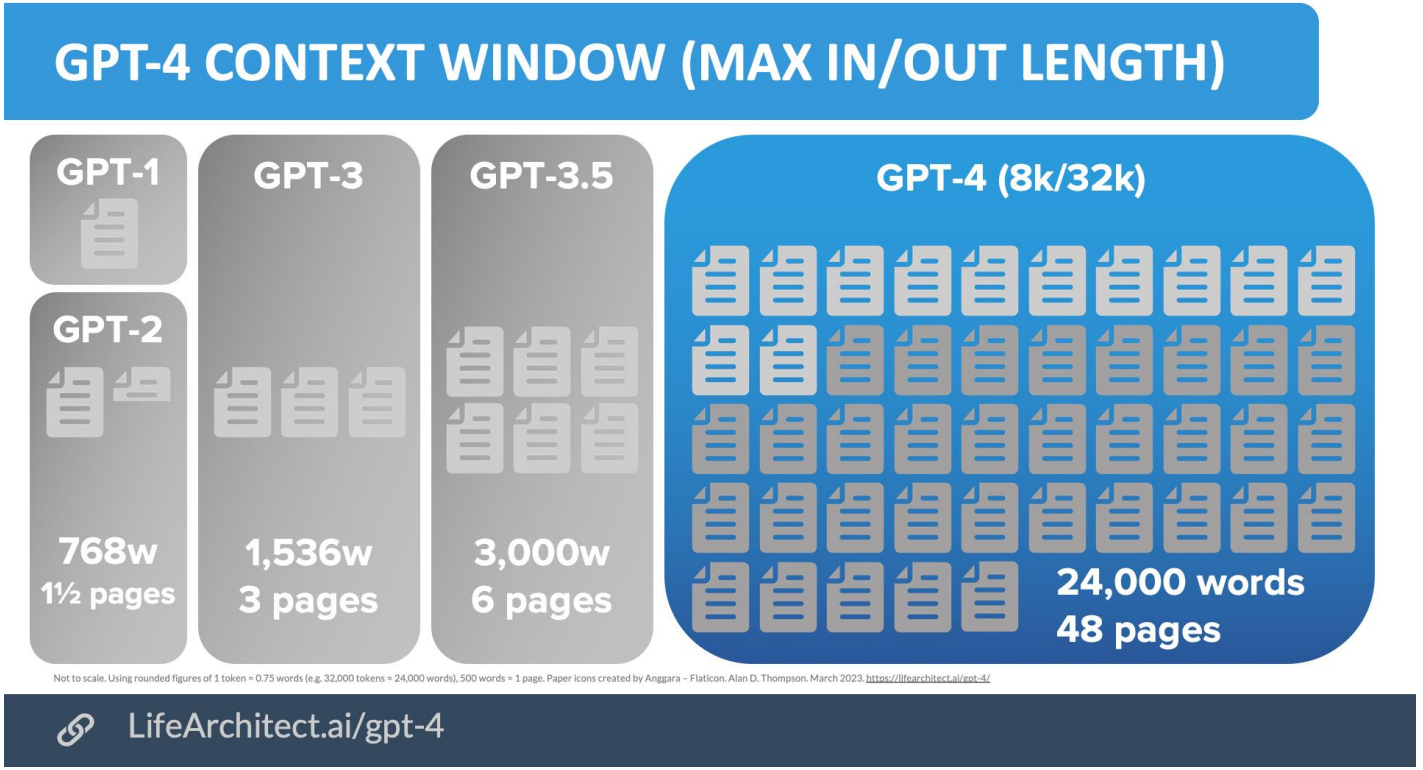
ChatGPT



Source: https://openai.com/blog/chatgpt

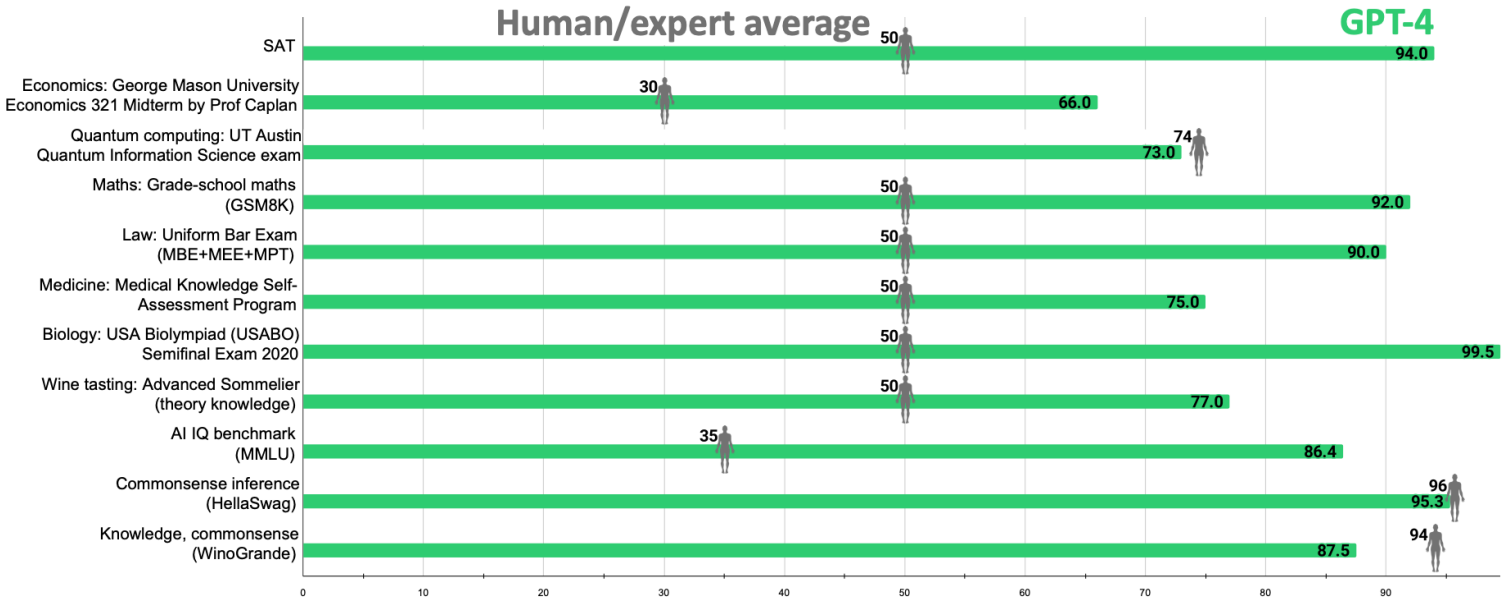
Generative AI

GTP n


GPT-4 CONTEXT WINDOW (MAX IN/OUT LENGTH)
GPT-1
GPT-2
768w
1½ pages
GPT-3
1,536w
3 pages
GPT-3.5
3,000w
6 pages
GPT-4 (8k/32k)
24,000 words
48 pages
Not to scale. Using rounded figures of 1 token = 0.75 words (e.g. 32,000 tokens = 24,000 words), 500 words = 1 page. Paper icons created by Anggara – Flaticon. Alan D. Thompson. March 2023. https://lifearchitect.ai/gpt-4/
LifeArchitect.ai/gpt-4

GPT vs Human

GPT-4 VS HUMAN TESTS (APR/2023)



Selected highlights only. Percentiles; 50 refers to the 50th percentile as average, and may not be the testing average for some tests. Alan D. Thompson. April 2023. https://lifearchitect.ai/iq-testing-ai/

LifeArchitect.ai/iq-testing-ai

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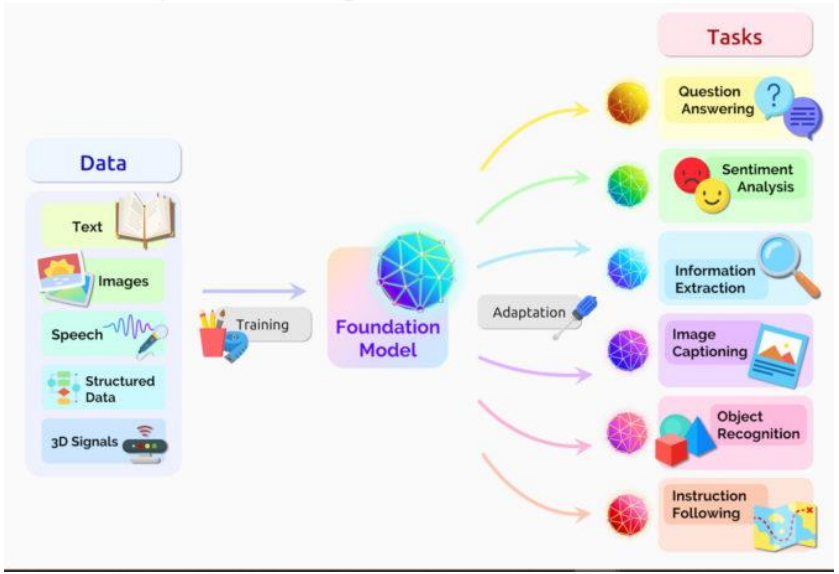
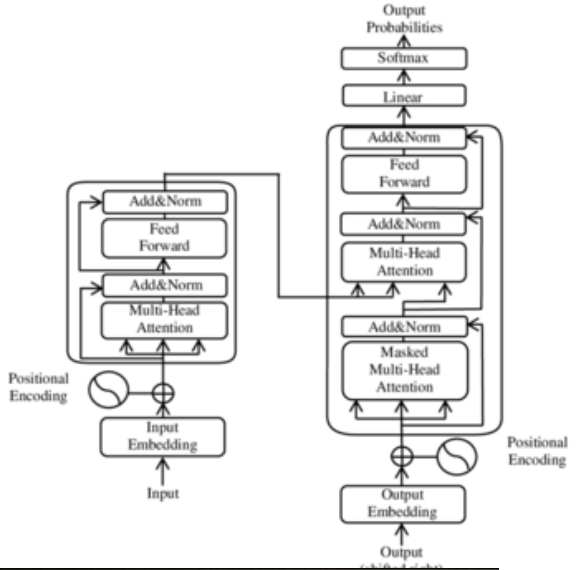
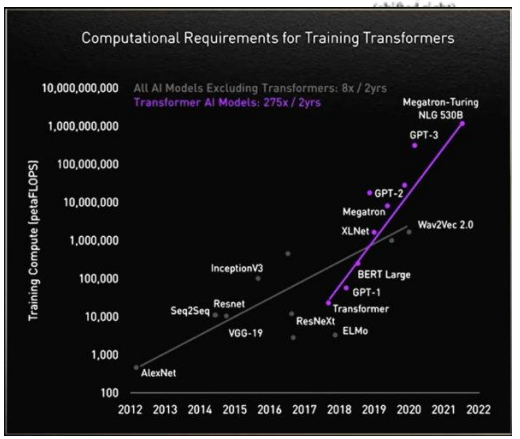
Transformer!



Source: https://blog.nvidia.com.br/2022/04/19/o-que-e-um-modelo-transformer/





"Attention is all we need": https://arxiv.org/abs/1706.03762

- Emotions;
- Non-determinism;
- Intelligent agents;
- Environment Intelligence;
- Increased intelligence.
- …
- Entities with “Free Will”.

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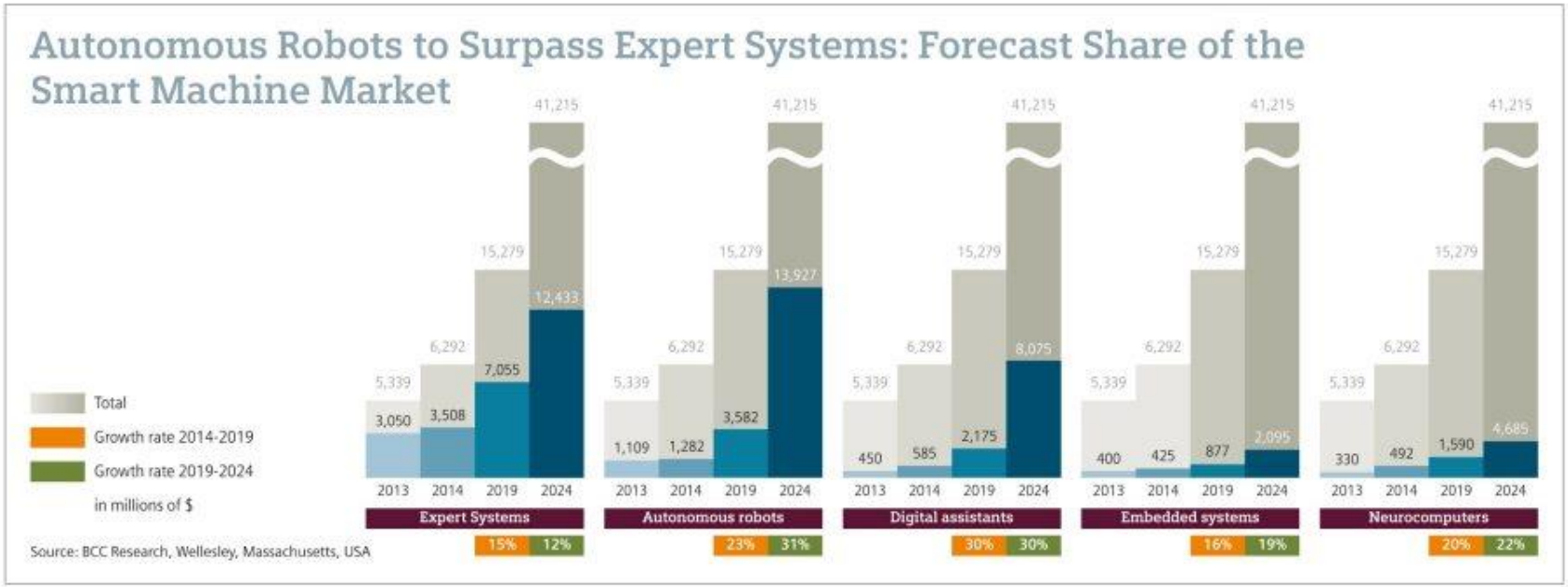
Forecasts for 2019-2024



Source: BCC Research

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"AI will help us solve big problems in genomics, energy, and climate science." Eric Schmidt, Google Chairman, Sept 14, 2015.

"Google wants to be the best in search. To reach that goal Google wants to have the world's top AI research laboratory." Larry Page, Google, 2006

"Siri and virtual assistants like her will soon change everything. I. Mean. Everything." Mike Elgan, in Computerworld, Sep 21, 2015

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“Our Intelligence is what makes us human, and AI is an extension of that quality.”

Yann LeCun (A.M. Turing Award 2018)

Universidade do Minho
Escola de Engenharia
Departamento de Informática

Artificial Intelligence: Past, Present and Future

LICENCIATURA EM ENGENHARIA INFORMÁTICA
MESTRADO integrado EM ENGENHARIA INFORMÁTICA
Inteligência Artificial
2025/26