



Inteligência Artificial Ciência da Computação

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Introdução - cap 1, Russell e Norvig



Universidade Federal Fluminense



Tópicos abordados

1. Linha do tempo de IA: passado ao infinito
2. O que é IA?
3. Tópicos de IA
4. Fundamentos da IA

Pré IA

- **Filosofia:** inteligência pode ser alcançada por um processo mecânico (ex. Aristóteles)
- **Tese de Church-Turing:** qualquer função computável é computável por uma máquina de Turing
- **Computadores reais:** Heath Robinson, Z-3, ABC/ENIAC

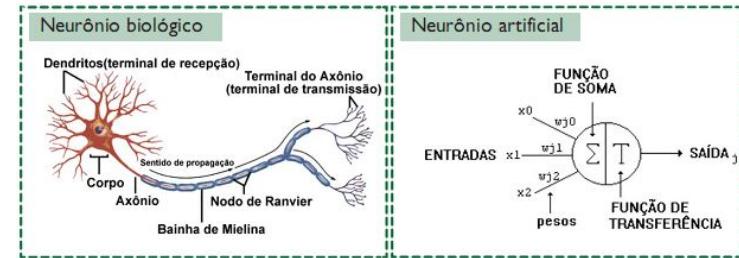
Mechanical Turk (1770)

- Dispositivo mecânico que jogava xadrez de forma "automática"
- Em execução por 84 anos enganou Franklin e Napoleão



A gestação da IA (1943-1955)

- Watch Grey Walter's nature-inspired 'tortoise'
- Ratio Club: Grey Walter e Alan Turing trocando ideias
- Modelo de neurônios artificiais
 - neurônios em estado ligado/desligado
 - Warren McCulloch e Walter Pitts (1943)
- Aprendizado Hebbiano
 - regra para modificar as conexões dos neurônios
 - Donald Hebb (1949)



A gestação da IA (1943-1955)

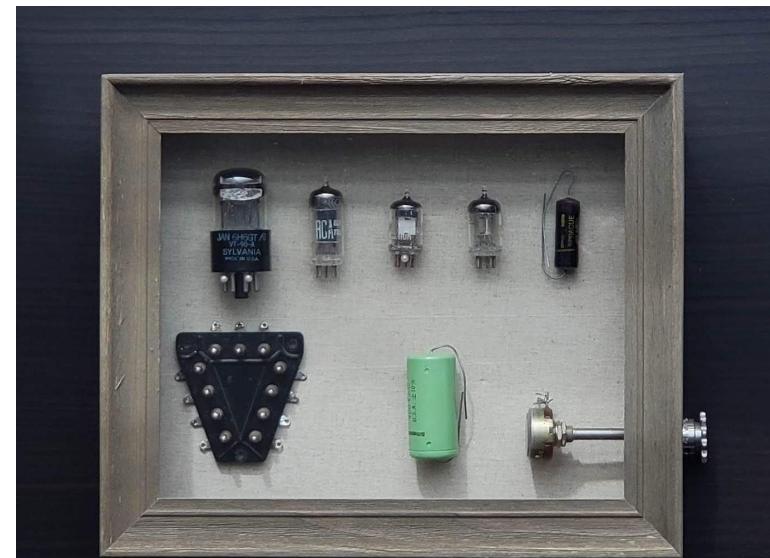
- 1950: I, Robot e as três leis da Robótica
 - Não machucar um ser humano, ou, por inação permitir que um ser humano se machuque
 - Obedecer suas ordens, desde que não fira a anterior
 - Proteger sua existência, desde que não fira as anteriores
 - Zeroth: prejudicar a humanidade, ou, por inação permitir que a humanidade venha a se prejudicar
- SNARC: primeiro computador baseado em redes neurais

A gestação da IA (1943-1955)

- SNARC (Stochastic Neural Analog Reinforcement Calculator
(SNARC): primeiro computador baseado em
redes neurais
 - Marvin Minsky e Dean Edmonds, 1950

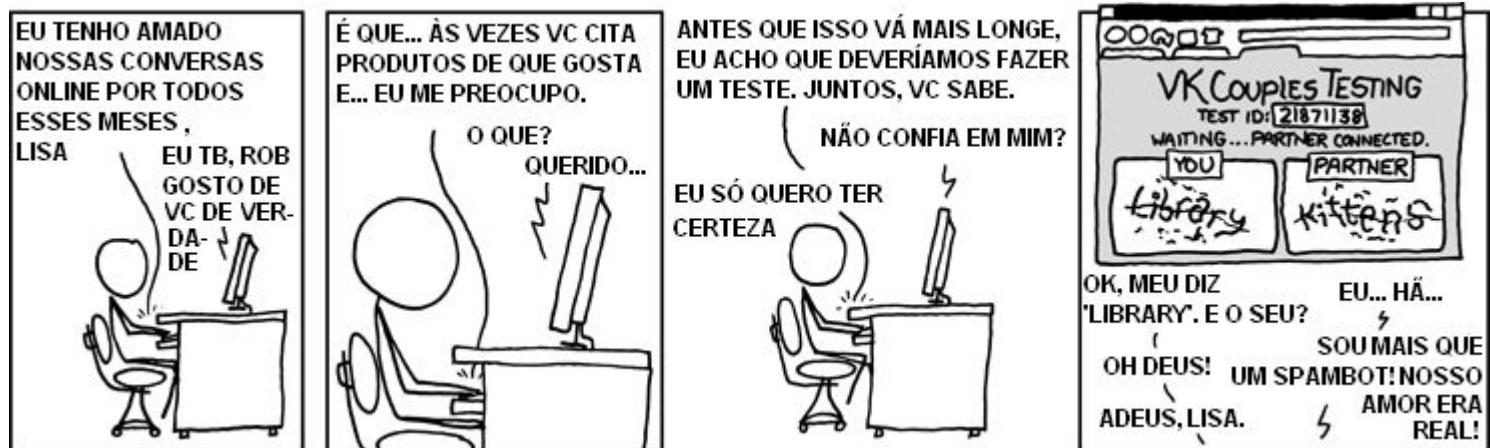
<https://historyof.ai/snarc/>

<https://www.youtube.com/watch?v=Zo68UjlWj8Y>



A gestação da IA

- Máquinas podem pensar?
- Teste de Turing (1950)



A sala chinesa

If you see this shape,
"什麼"
followed by this shape,
"帶來"
followed by this shape,
"快樂"

then produce this shape,
"爲天"
followed by this shape,
"下式".



O nascimento da IA

- Summer Workshop com 10 pesquisadores
- Especialistas em
 - Estudo da Inteligência
 - Teoria de Autômatos
 - Redes Neurais

A PROPOSAL FOR THE
DARTMOUTH SUMMER RESEARCH PROJECT
ON ARTIFICIAL INTELLIGENCE

J. McCarthy, Dartmouth College
M. L. Minsky, Harvard University
N. Rochester, I.B.M. Corporation
C. E. Shannon, Bell Telephone Laboratories



O nascimento da IA (1956)

- John McCarthy usou o termo "Inteligência Artificial" pela primeira vez
- Top Down X Bottom Up approach
 - Pré-programar computadores com leis que regem o comportamento humano X simular células cerebrais que aprendam novos comportamentos
- Allen Newell e Herbert Simon apresentam um programa de raciocínio, baseado em lógica
 - o programa conseguia provar teoremas

O nascimento da IA

- *"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"*
 - Duplicar faculdades humanas como criatividade, automelhora e uso de linguagem
 - Construir máquinas que funcionam autonomamente em ambientes complexos e dinâmicos

Entusiasmo

- *Machines will be capable, within twenty years, of doing any work a man can do —Herbert Simon*
- *Within 10 years the problems of artificial intelligence will be substantially solved.*
—Marvin Minsky
- *I visualize a time when we will be to robots what dogs are to humans, and I'm rooting for the machines. —Claude Shannon*

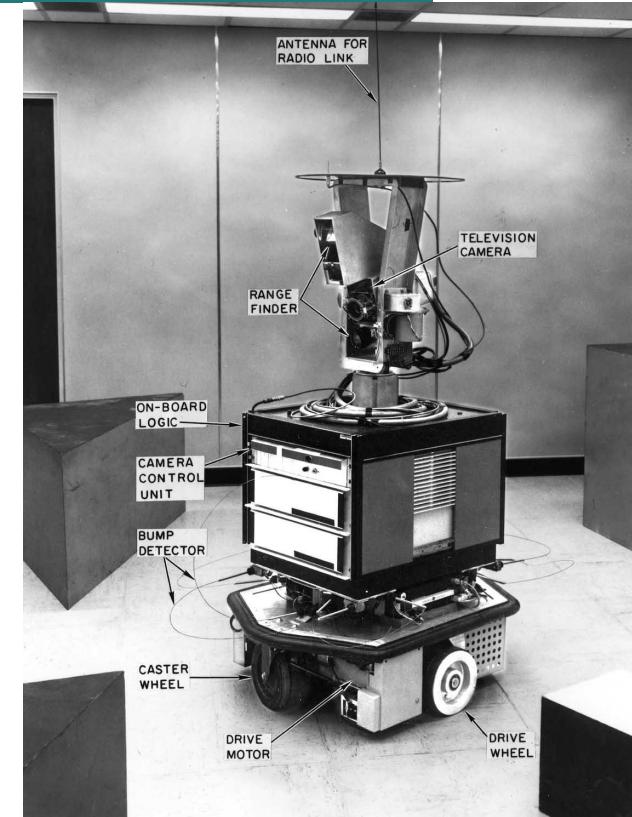
Entusiasmo e expectativa (1952-1969)

- Reconhecimento de fala
 - "Audrey" (1952): reconhecia dígitos falados por uma única voz
 - "Shoebox" (IBM, 1962): entendia 16 palavras
 - Harpy (CMU, ~70s): entendia 1011 palavras
- General Problem Solver -> common sense reasoning
- General Theorem Prover
- Linguagem Funcional LISP

Entusiasmo e Expectativas

- Robótica: Shakey, 1966
 - <http://www.youtube.com/watch?v=qXdn6ynwpil>
- Programa de conversação
 - Eliza

```
=====
 EEEEEE L I II III ZZZZZZ A A
 E L I Z Z A A
 EEEE L I Z A A
 E L I Z Z A A
 EEEEEEE L LLLL L I ZZZZZZ A A
 =====
 ELIZA > (PLEASE TYPE IN ALL CAPS) WHAT'S YOUR NAME DEAR ?
 AMIT
 ELIZA > HI, I'M ELIZA, WHAT DO YOU WANT TO TALK ABOUT ?
 AMIT > CAN I TALK ABOÙT MY PROBLEM ?
 ELIZA > SURE... !
 AMIT > DUE TO ON GOING EXAMS IN COLLEGE, I HAVE A LOT OF STRESS.
 ELIZA > PLEASE RELAX A LITTLE. SLEEP WELL.
 AMIT > THANKS FOR YOUR ADVICE.
 ELIZA > NO MENTION.
 AMIT > BYE
 ELIZA > BYE AND KEEP IN TOUCH...
 =====
```



Eliza, 1966



Homens são todos iguais.
Eles estão sempre encrencando
conosco sobre uma coisa ou outra.
Bom, ... meu namorado me fez vir aqui.
Sim, ele diz que eu estou deprimida
todo o tempo.
É verdade. Eu estou infeliz.

Eu preciso de ajuda.

Talvez eu aprendesse a lidar com
minha mãe.



Em que sentido ?
Você pode pensar em um exemplo
específico?
Seu namorado fez você vir aqui?
Eu sinto muito que você esteja deprimida.

Você acha que vir aqui ajudará você a
não ser infeliz ?
O que significaria para você se
conseguisse alguma ajuda?
Fale mais sobre sua mãe.

Eliza, 1966

- Exemplo de regra: *SE pessoa diz “Eu gosto X”, ENTÃO responda “Por que você gosta X?”*

Diálogo 1

Algo me aborrece.

O que está aborrecendo você?

Meu namorado.

Onde está o seu namorado?

Meu namorado está viajando.

Há quanto tempo seu namorado está viajando?

Eliza

Diálogo 2

Algo me aborrece.

Minha cabeça.

Minha cabeça está sobre os meus ombros!

O que está aborrecendo você?

Onde está a sua cabeça ?

Há quanto tempo a sua cabeça
está sobre os seus ombros?

Correspondência de palavras chave: Não há entendimento
sobre o **significado**

Uma dose de realidade (AI Winter)

- Herbert Simon em 1957:
 - "In 10 years a computer program will be a chess champion"
- *The spirit is willing but the flesh is weak* ->
 - *The vodka is good but the meat is rotten*
- Problemas intratáveis X poder computacional
- *Lighthill Report:*

http://www.youtube.com/watch?v=yReDbeY7ZMU&list=PLuY3XxNu8Jn9C5gTWDvLV_KZgEc2nWB9A&index=1



"It's cool, it's sexy." (Franky Rosenblatt 1957)



"It's linear. It sucks" (Minsky, Papert 1969)..

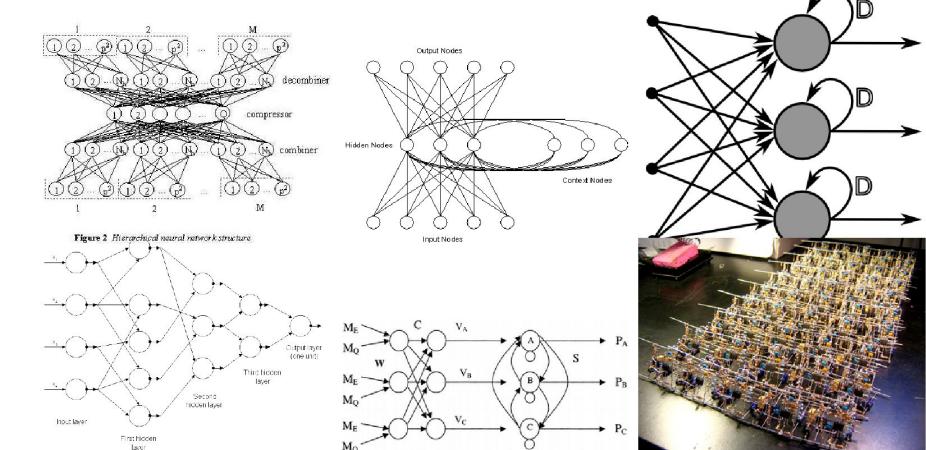
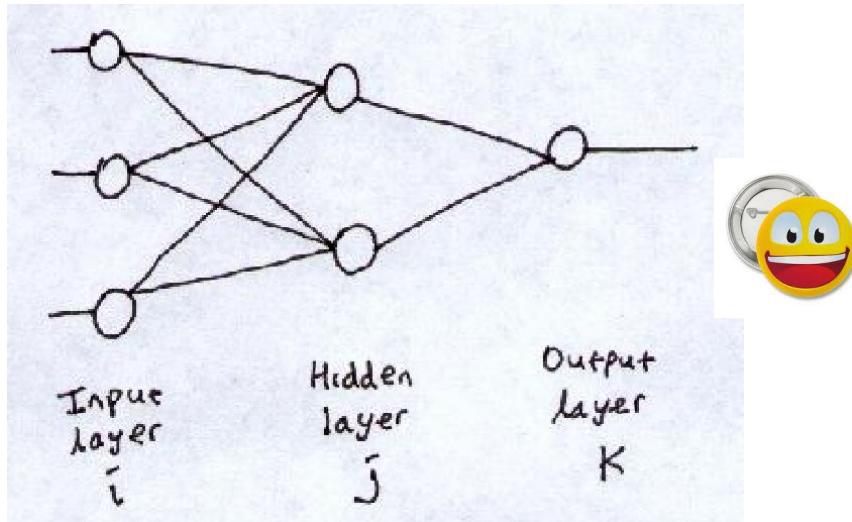
Redes
neurais

... and people believed Minksy, which made them sad ..



Com o pé mais no chão...

- Indústria de IA
 - sistemas especialistas
 - Japanese Fifth Generation usando Prolog
- Retorno das redes neurais



* From NIPS Tutorial on Deep Networks

Deixando de ser tão anti-social (1987-hoje)

- Simbolismo X conexionismo
- Métodos científicos
 - Lógica, teoria da informação, modelagem estocástica, otimização, métodos formais
- Reconhecimento de fala com HMM
 - teoria matemática rigorosa
 - treinado com dados reais
- Novas áreas
 - Datamining: estatística, reconhecimento de padrões
 - Raciocínio probabilístico
 - Robótica, visão computacional, representação do conhecimento

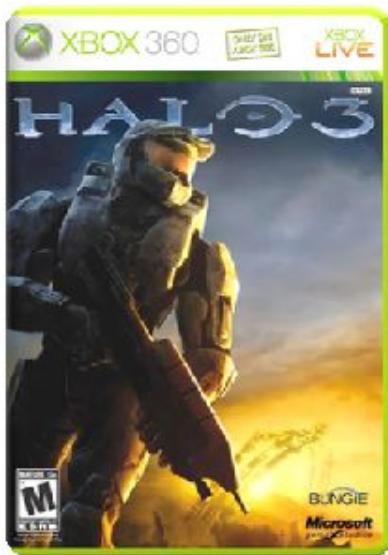
Deep Blue



May 11th, 1997
Computer won world champion of chess
(Deep Blue) (Gary Kasparov)



Jogos: digitais, tabuleiro, GGP



Web Page ranking

A screenshot of a Google search results page. The search query "machine learning" is entered in the search bar. The results are filtered by "Web". The first result is a link to the Wikipedia page on machine learning. The second result is a link to a Coursera course on machine learning. The third result is a link to CS 229: Machine Learning at Stanford. The fourth result is a link to download free content from Stanford on iTunes. The fifth result is a link to the Machine Learning Department at Carnegie Mellon University. The sixth result is a link to a machine learning weblog.

+You Search Images Maps Play YouTube News Gmail Drive Calendar More .

Google machine learning

Web Images Maps Shopping News More Search tools

About 158,000,000 results (0.25 seconds)

[Machine learning - Wikipedia, the free encyclopedia](#)
en.wikipedia.org/wiki/Machine_learning
Machine learning, a branch of artificial intelligence, is about the construction and study of systems that can learn from data. For example, a machine learning ...

[List of machine learning - Category:Machine learning - Monte Carlo Machine ...](#)

[Machine Learning | Coursera](#)
https://www.coursera.org/course/ml
Machine learning is the science of getting computers to act without being explicitly programmed. In the past decade, machine learning has given us self-driving ...
6,519 people +1'd this

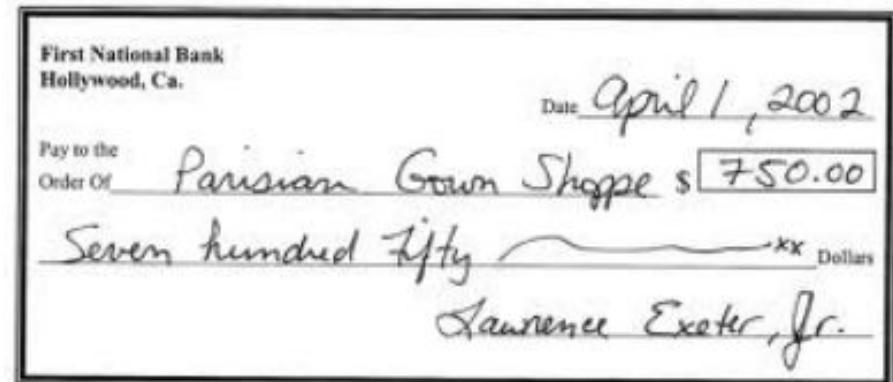
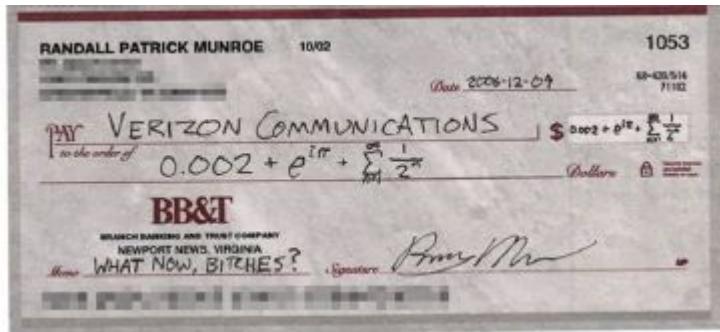
[CS 229: Machine Learning](#)
cs229.stanford.edu/
Check out this year's awesome projects at Fall 2012 Projects. Come check out the cool new projects during the CS229 Poster Session this Thursday December ...

[Machine Learning - Download free content from Stanford on iTunes](#)
https://itunes.apple.com/usitunes-u/machine-learning/id384233048
Download or subscribe to free content from Machine Learning by Stanford on iTunes.

[Machine Learning Department - Carnegie Mellon University](#)
www.ml.cmu.edu/
Large group with projects in robot learning, data mining for manufacturing and in multimedia databases, causal inference, and disclosure limitation.

[Machine Learning \(Theory\)](#)
hunch.net/
Jan 31, 2013 – A collaborative machine learning weblog by John Langford.

Reconhecimento de escrita



Planejamento de rota



Veículos autônomos

- visão, percepção, aprendizado



Veículos aéreos autônomos

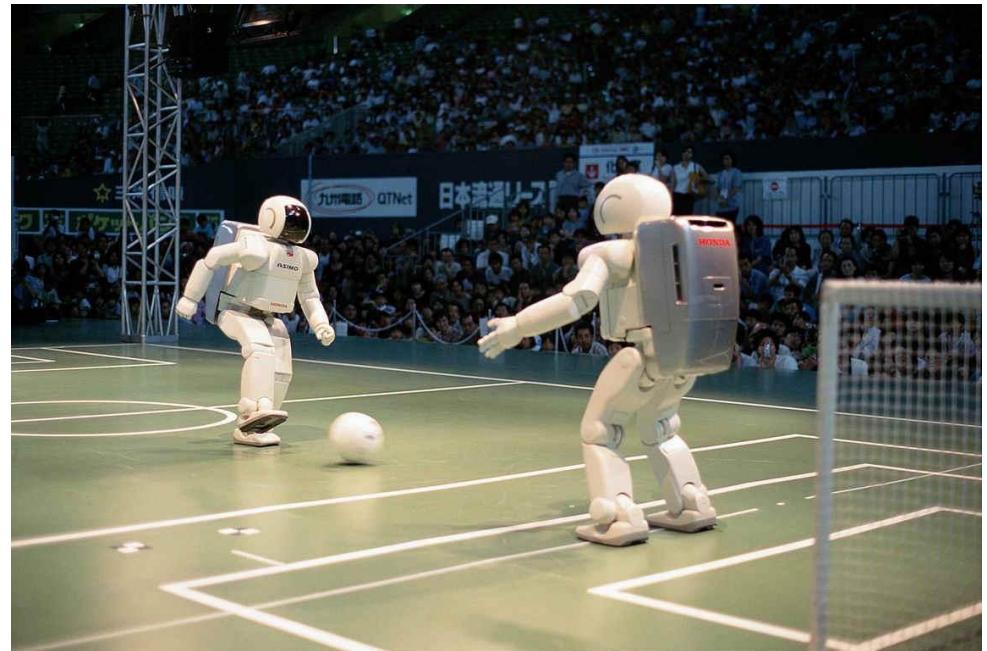
- International Aerial Robotics Competition



http://www.ted.com/talks/lang/en/vijay_kumar_robots_that_fly_and_cooperate.html

Robótica

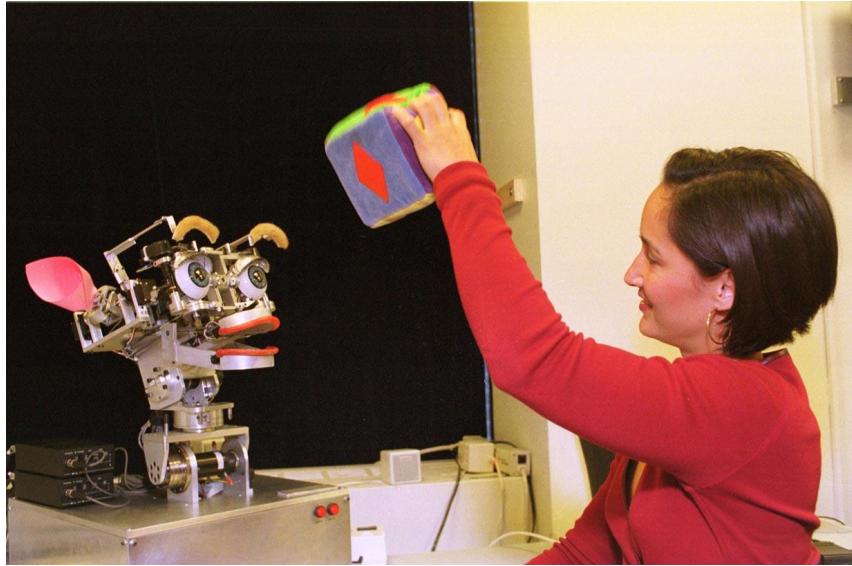
<http://www.youtube.com/watch?v=R8UeT9r4cmg>



Robôs emocionais

Kismet, MIT, 2000

<http://www.youtube.com/watch?v=8KRZX5KL4fA>



Robótica na ciência e cirurgias

By Victoria Gill

Science reporter, BBC News

Scientists have created an ideal colleague - a robot that performs hundreds of repetitive experiments.

The robot, called Adam, is the first machine to have independently "discovered new scientific knowledge".

It has already identified the role of several genes in yeast cells, and is able to plan further experiments to test its own hypotheses.

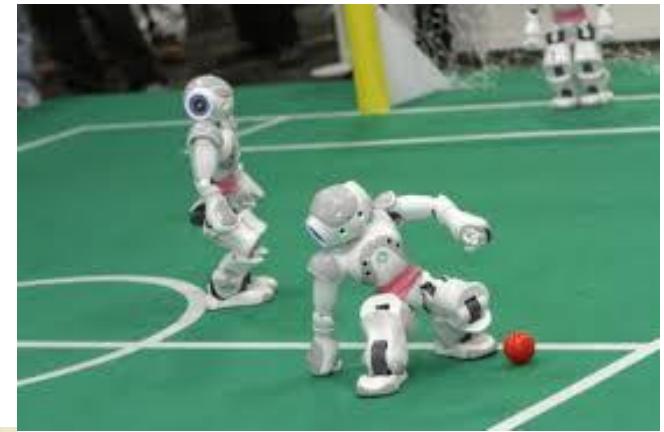


Adam discovered the role of 12 different genes in yeast cells

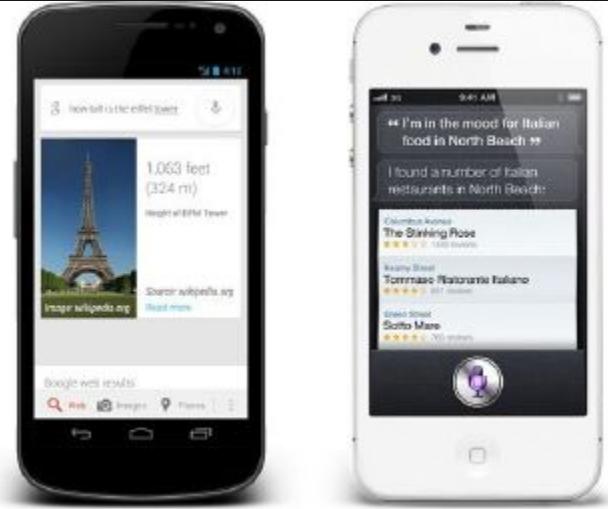


Robocup

<http://www.youtube.com/watch?v=XLKKbz2mNyo>



Assistentes virtuais



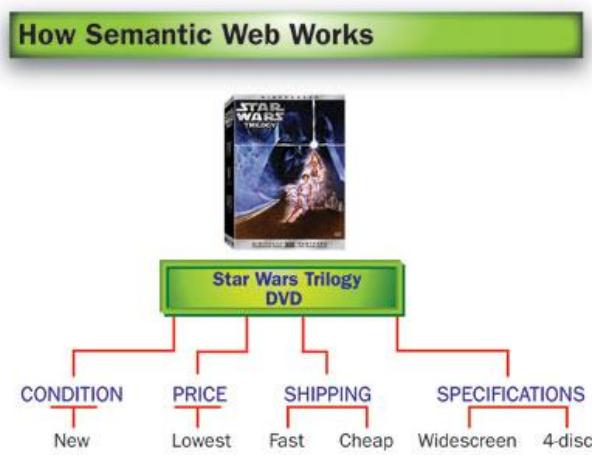
E físicos



Serviços web

● Web semântica

- Google Graph knowledge
- Processamento de linguagem natural
- Ontologias
- Dados abertos ligados



The screenshot shows a Google search results page for the query 'taj mahal'. The first result is a link to the Wikipedia page for the Taj Mahal, which includes a map of Agra, India, showing its location relative to other landmarks like the Red Fort and Agra Fort. The page also lists related entities such as 'Trump Taj Mahal Casino' and 'Henry Saint Clair Fredericks'.

Sistemas de Recomendação

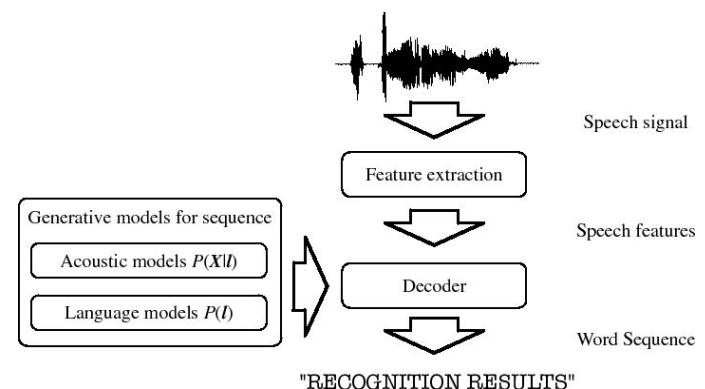
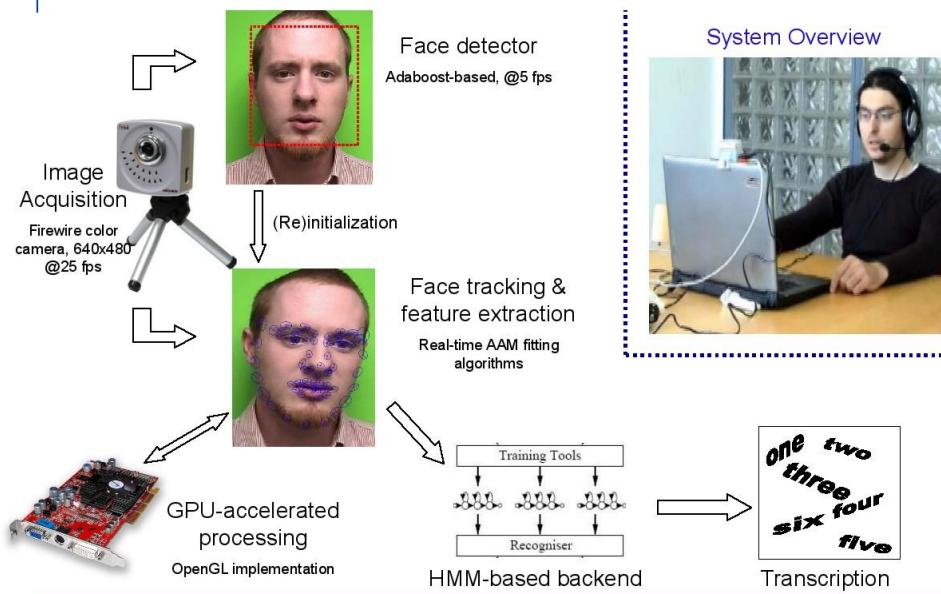
The screenshot shows the Netflix homepage. At the top, there are navigation links: Watch Instantly, Just for Kids, Browse DVDs, Your Queue, and Suggestions For You. Below these are genre filters: Comedy, New Arrivals, Star Play, and Instantly to your TV. A section titled "New Releases" displays movie posters for "The Next Three Days" and "Raising Hope". A callout box for "The Next Three Days" provides a plot summary: "When his wife is sent to jail on murder charges she fervently denies it, a college professor hatches a meticulous plan for the ultimate prison escape." It also lists the starring actors (Russell Crowe, Elizabeth Banks), director (Paul Haggis), and availability (Streaming, DVD, and Blu-ray). Below this, there's a section for "Newly added to Netflix" featuring "Red" and "Office Space". A "Watch It Again" section at the bottom shows posters for "Toy Story", "The Fighter", and "The Hangover".

The screenshot shows the Amazon product page for "The Hangover" (Blu-ray). The main product image features the three main stars. Below it, the title "The Hangover [Blu-ray]" is displayed along with the starring actors (Bradley Cooper, Heather Graham) and format (Blu-ray). A red box highlights the "User Rating" section, which shows a 4.5-star rating based on 23 customer reviews. To the right, there's an "OMORE Recommendation" section with a 5-star rating. The page includes a "Sign up to be notified when this item becomes available" button and a "1st to know" box. The URL in the address bar is http://www.amazon.com/Hangover-Blu-ray-Bradley-Cooper/dp/B001UV4XEW/ref=sr_1_5.

Reconhecimento de fala

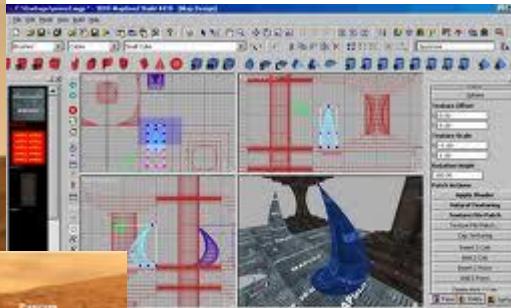
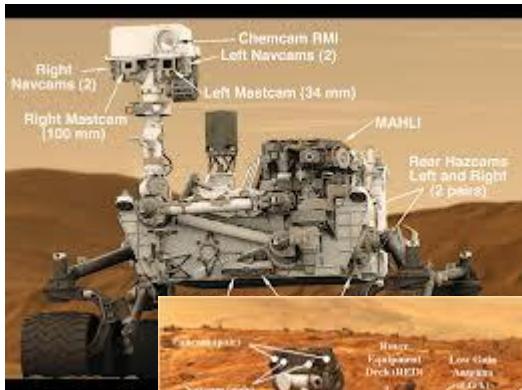
- Sistemas de gerenciamento de diálogo
- Extração de fala por expressões faciais

Towards a Real-Time AV-ASR Prototype

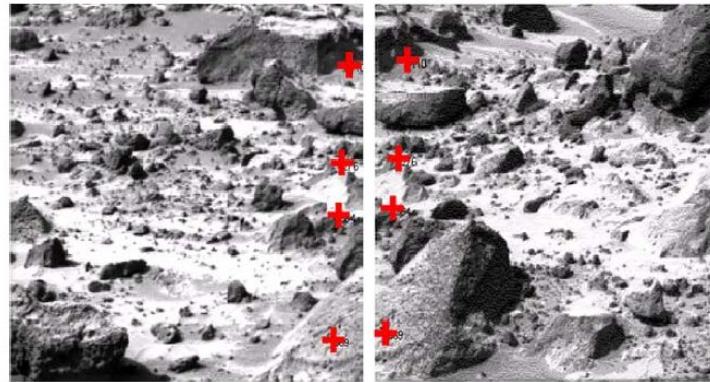


Planejamento e escalonamento autônomo

- Agentes remotos de exploração
- Planejamento de respostas de emergência



Visão computacional



Exploração em Marte



Google Glass



Detecção de faces e expressões

Tradução automática

The screenshot shows the Google Translate interface. At the top, there's a navigation bar with links for +You, Search, Images, Maps, Play, YouTube, News, Gmail, Drive, Calendar, and More. Below the bar is the Google logo and a red "SIGN IN" button. The main area has tabs for Translate, From: French - detected, To: English, and a "Translate" button. There are also buttons for star ratings and sharing.

From: French - detected **To:** English

French - detected

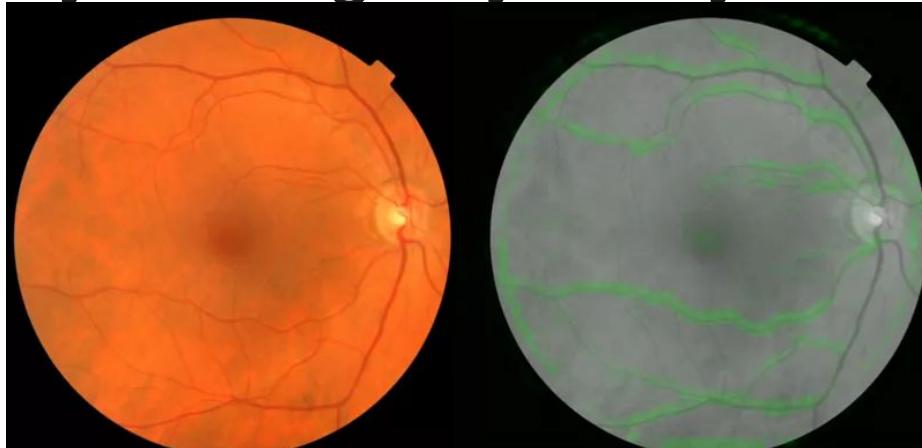
Le premier ministre a lancé une autre piste – sans l'expliquer et beaucoup des experts présents à la conférence environnementale n'ont pu le faire : la mobilisation d'une partie des gains financiers perçus sur le parc nucléaire français. "Pendant toute la durée de vie restante de nos centrales, et tout en assurant une sécurité maximale, a déclaré Jean-Marc Ayrault, notre parc nucléaire sera mis à contribution sans rupture d'approvisionnement".

The Prime Minister has launched another track - without explaining and many experts at the environmental conference could not do : the mobilization of some of the financial gains earned on the French nuclear fleet. "Throughout the remaining life of our plants, and while ensuring maximum security, said Jean-Marc Ayrault, our nuclear fleet will be involved without supply disruption."

Turn off instant translation About Google Translate Mobile Privacy Help Send feedback

Healthcare

Predicting Heart disease
by looking at your eyes

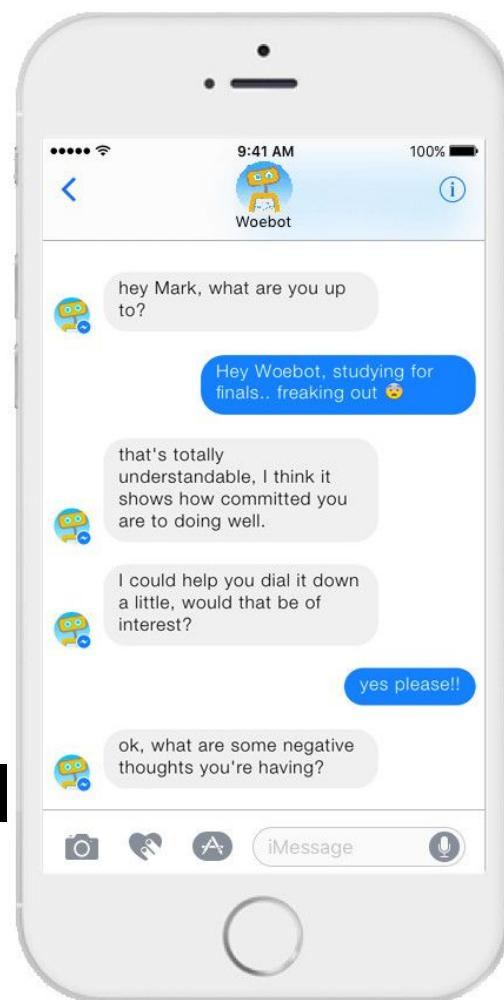
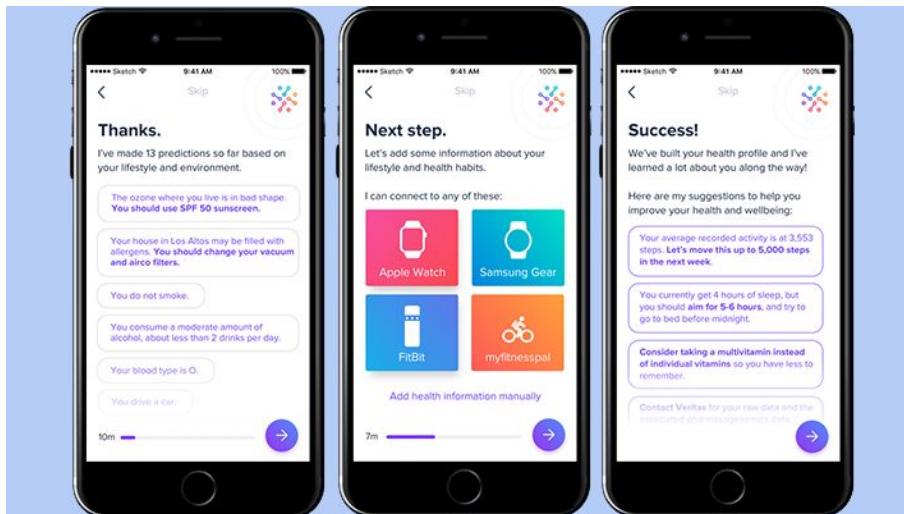


Detecting Skin cancer



Mental healthcare

Diagnosis explanation with
NLP



Woebot: treating mental disorders with conversational agents

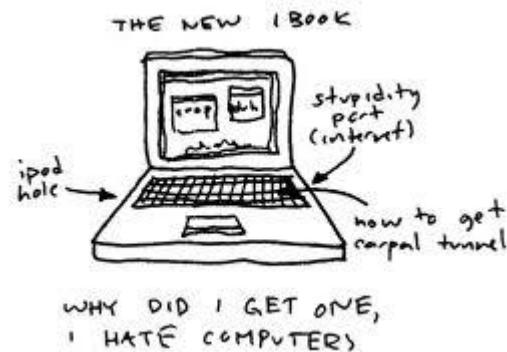
Computação criativa

- The painting fool
- Geração de poemas e histórias
- Criação de músicas
- Poesia do Google



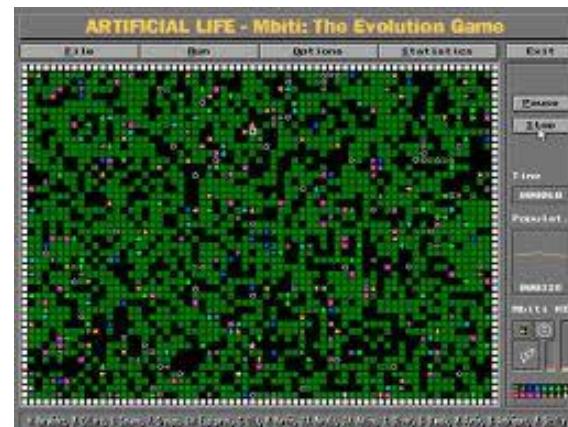
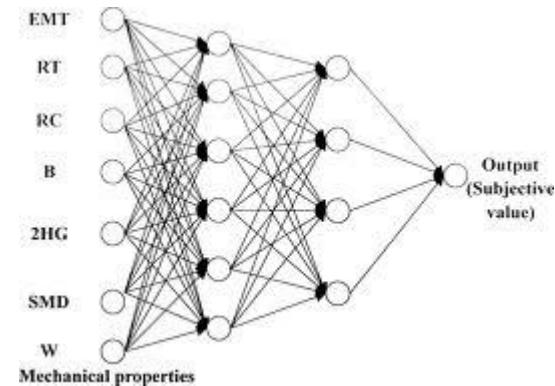
Análise de sentimentos

- Análise de tweets para pesquisas políticas, esportes, marketing



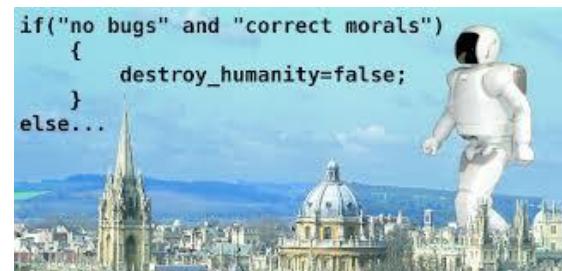
Computação inspirada na natureza e na vida

- Algoritmos genéticos
- Enxame de partículas
- Colônias de formigas
- Redes neurais
- Vida artificial
- Agentes emocionais



General AI

- Algoritmo universal para aprender e agir em qualquer ambiente
 - Retorno às origens: máquinas que pensem, aprendam, criem
- General Game Playing
 - algoritmos capazes de jogar qualquer jogo, dado apenas um conhecimento preliminar de suas regras



Geração de linguagem

<p>A person riding a motorcycle on a dirt road.</p> 	<p>Two dogs play in the grass.</p> 	<p>A skateboarder does a trick on a ramp.</p> 	<p>A dog is jumping to catch a frisbee.</p> 
<p>A group of young people playing a game of frisbee.</p> 	<p>Two hockey players are fighting over the puck.</p> 	<p>A little girl in a pink hat is blowing bubbles.</p> 	<p>A refrigerator filled with lots of food and drinks.</p> 
<p>A herd of elephants walking across a dry grass field.</p> 	<p>A close up of a cat laying on a couch.</p> 	<p>A red motorcycle parked on the side of the road.</p> 	<p>A yellow school bus parked in a parking lot.</p> 

Describes without errors

Describes with minor errors

Somewhat related to the image

Unrelated to the image

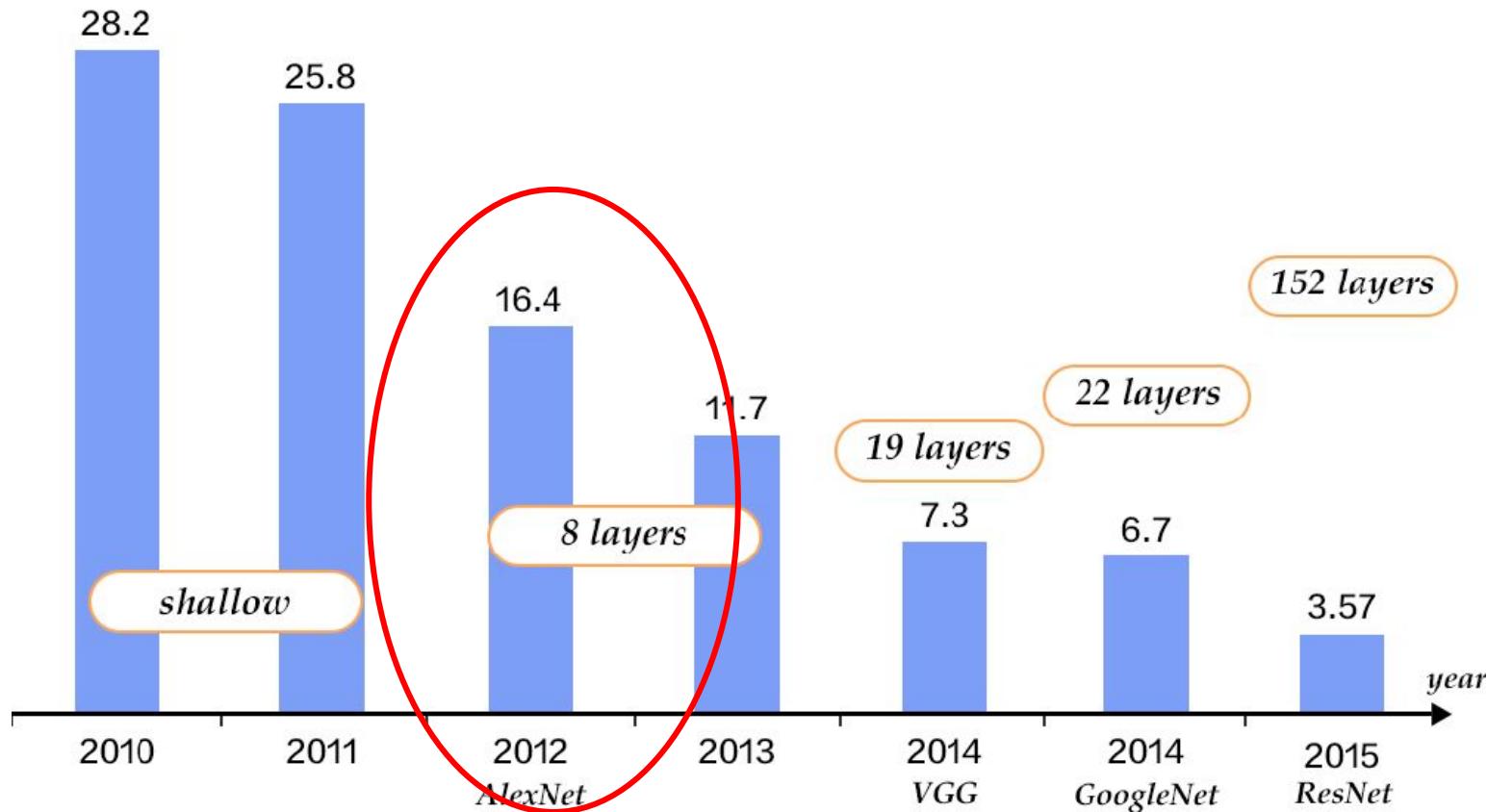
Figure 5. A selection of evaluation results, grouped by human rating.

Watson vence os dois maiores campeões do Jeopardy! (2011)

- NLP, recuperação de informação, aprendizado de máquina, representação de conhecimento, processamento paralelo massivo
- http://www.youtube.com/watch?v=oUj9AzSE_9c



Deep Learning



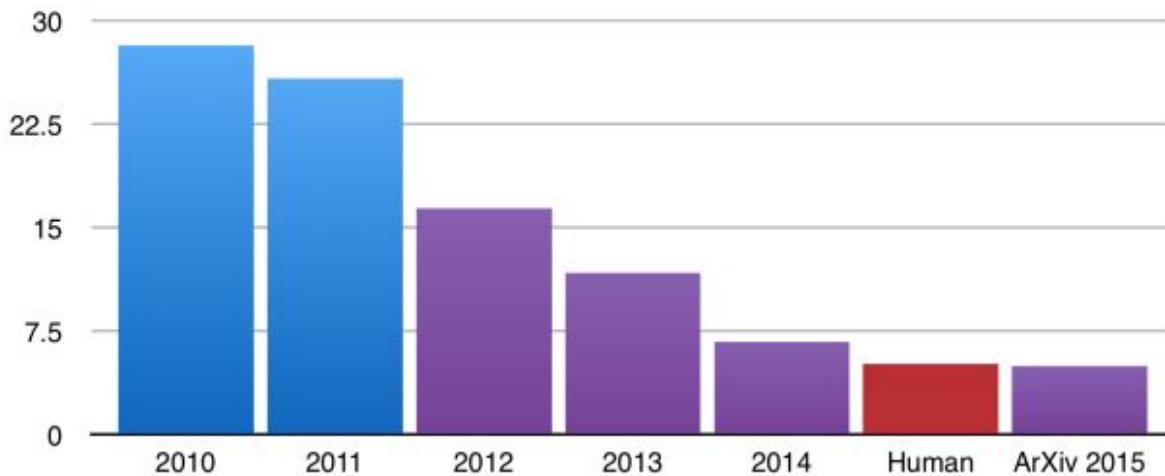
Vencendo humanos agora com imagens (2015)

1.2 M de imagens em 1000 categorias

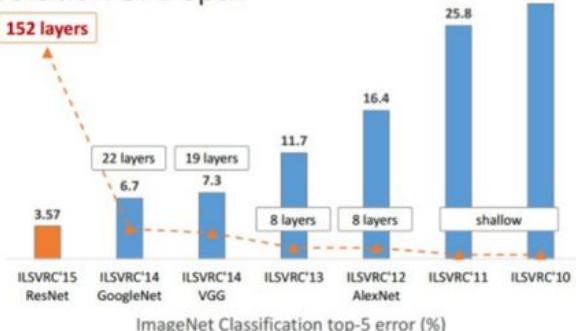


Vencendo humanos agora com imagens (2015)

ILSVRC top-5 error on ImageNet



Revolution of Depth



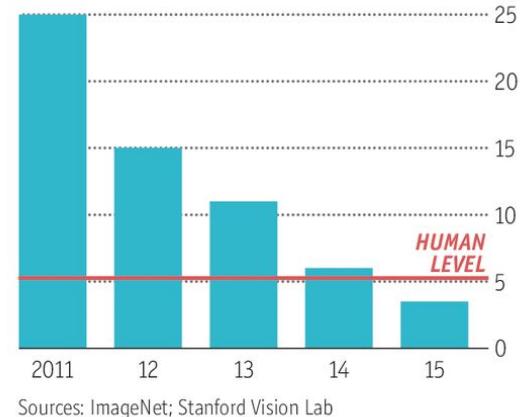
ICCV15

ImageNet Classification top-5 error (%)

Kaiming He, Xiangyu Zhang, Shaoqing Ren, & Jian Sun. "Deep Residual Learning for Image Recognition". arXiv 2015.

Ever cleverer

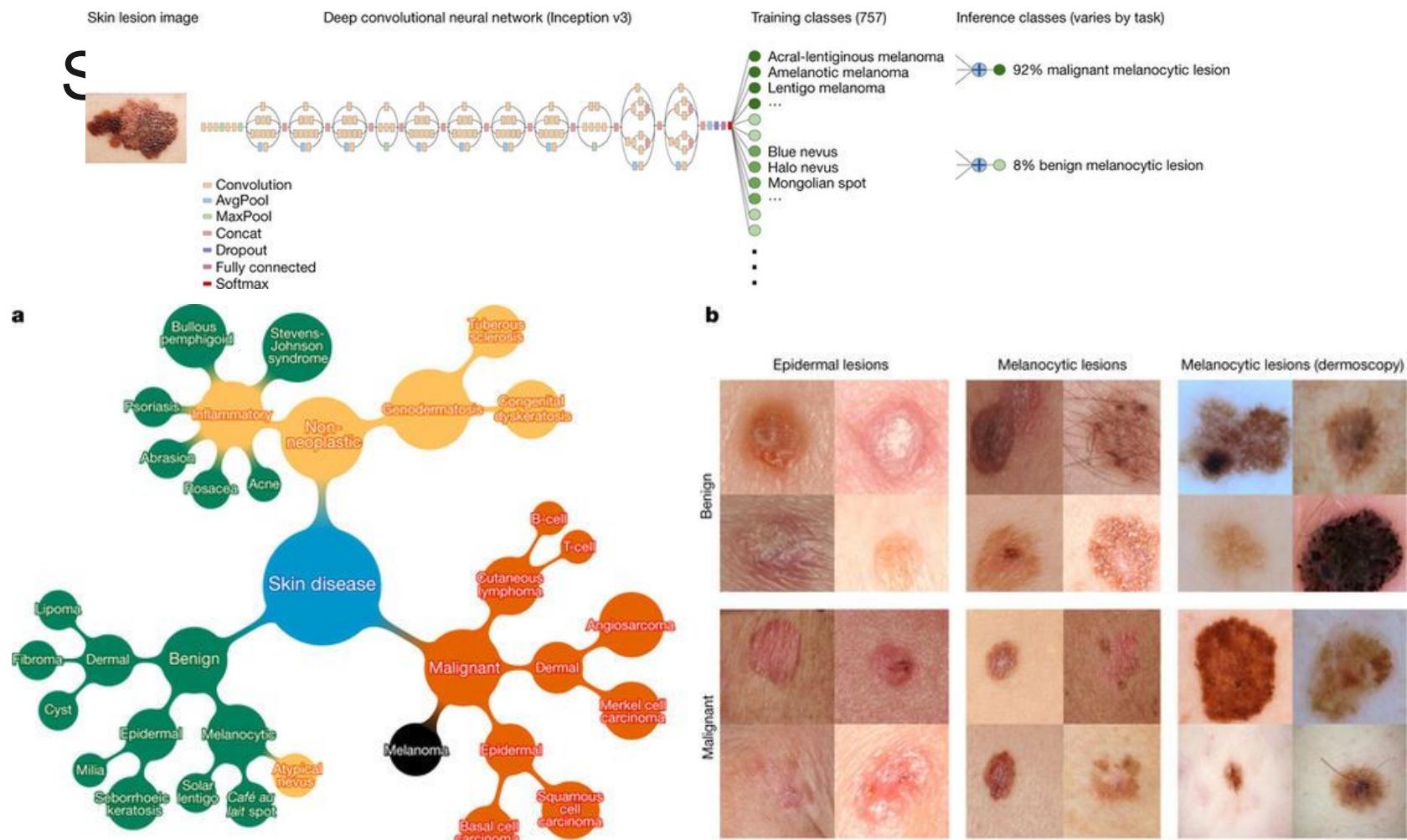
Error rates on ImageNet Visual Recognition Challenge, %



Sources: ImageNet; Stanford Vision Lab

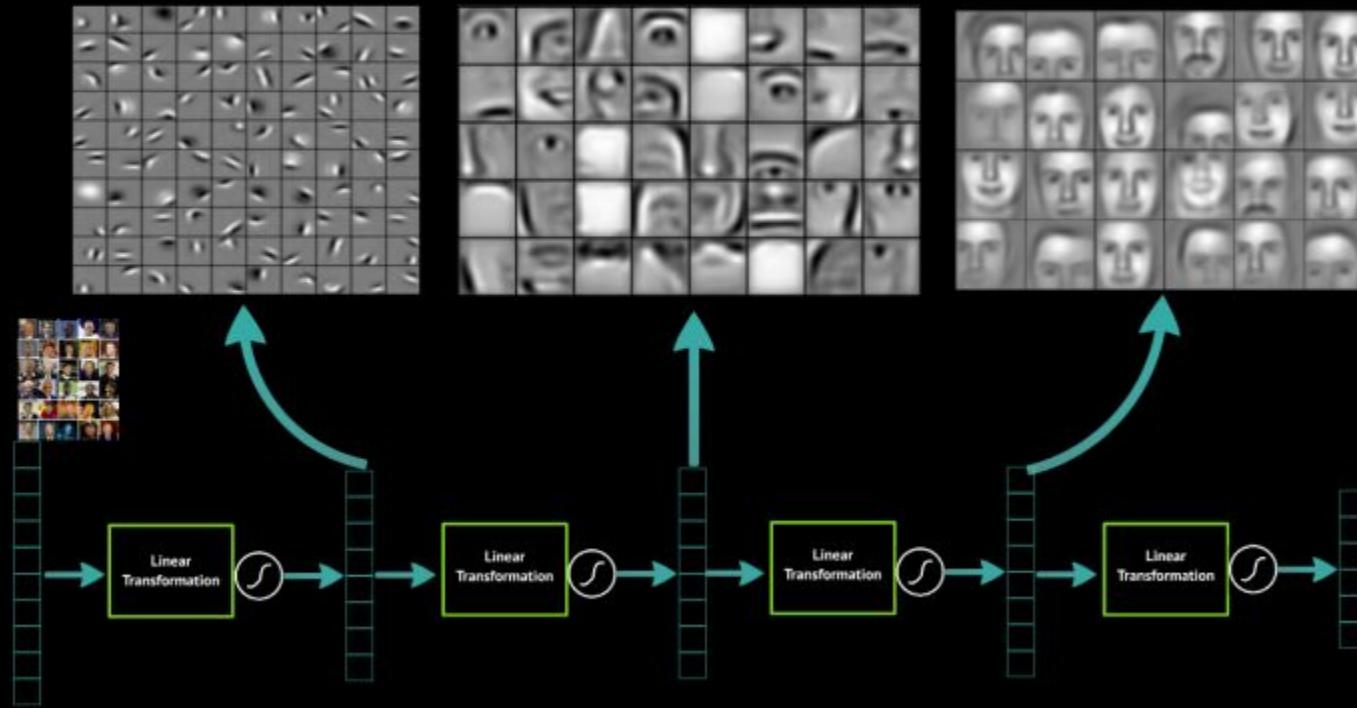
Economist.com

Tão bom quanto o médico? (2017)

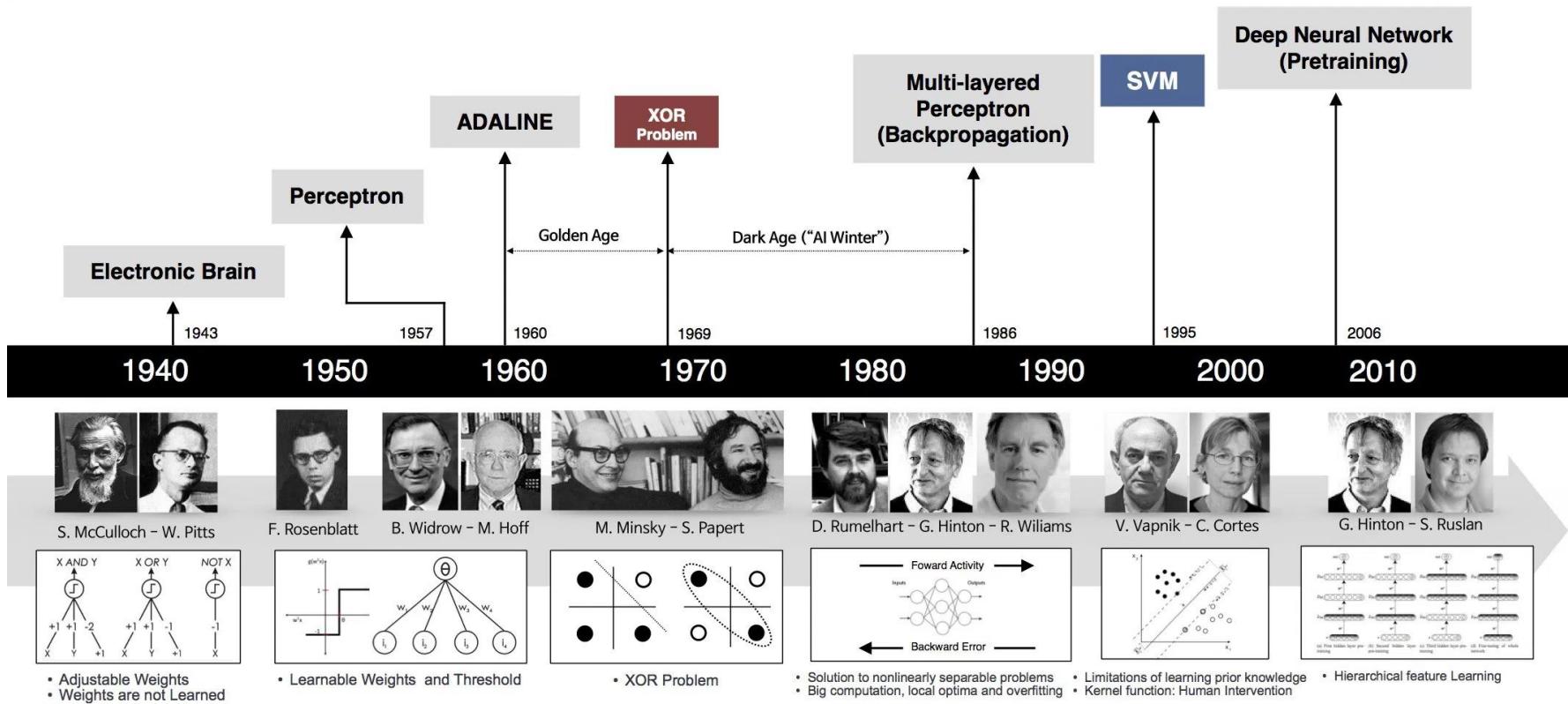


Deep Learning

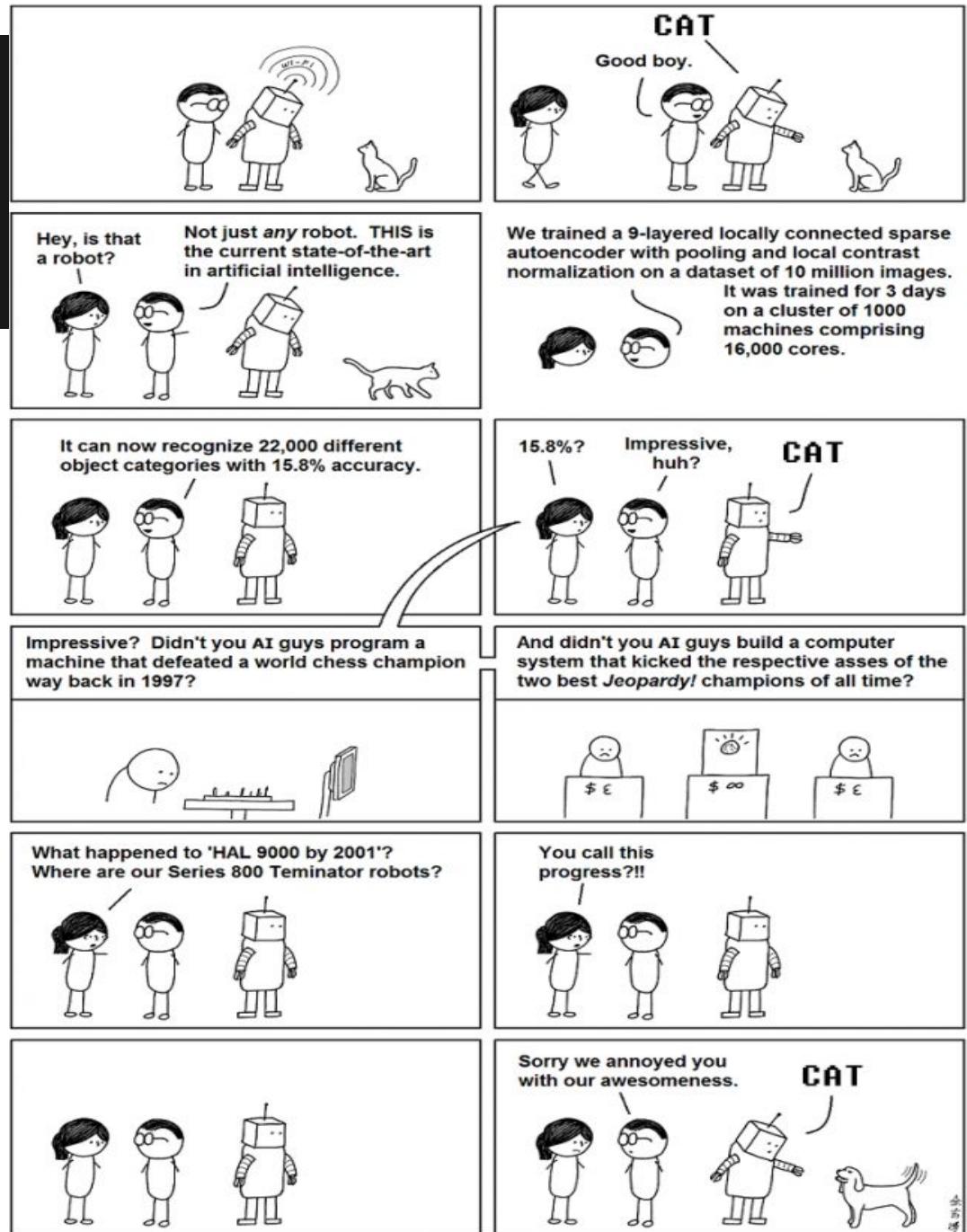
Deep Learning learns layers of features



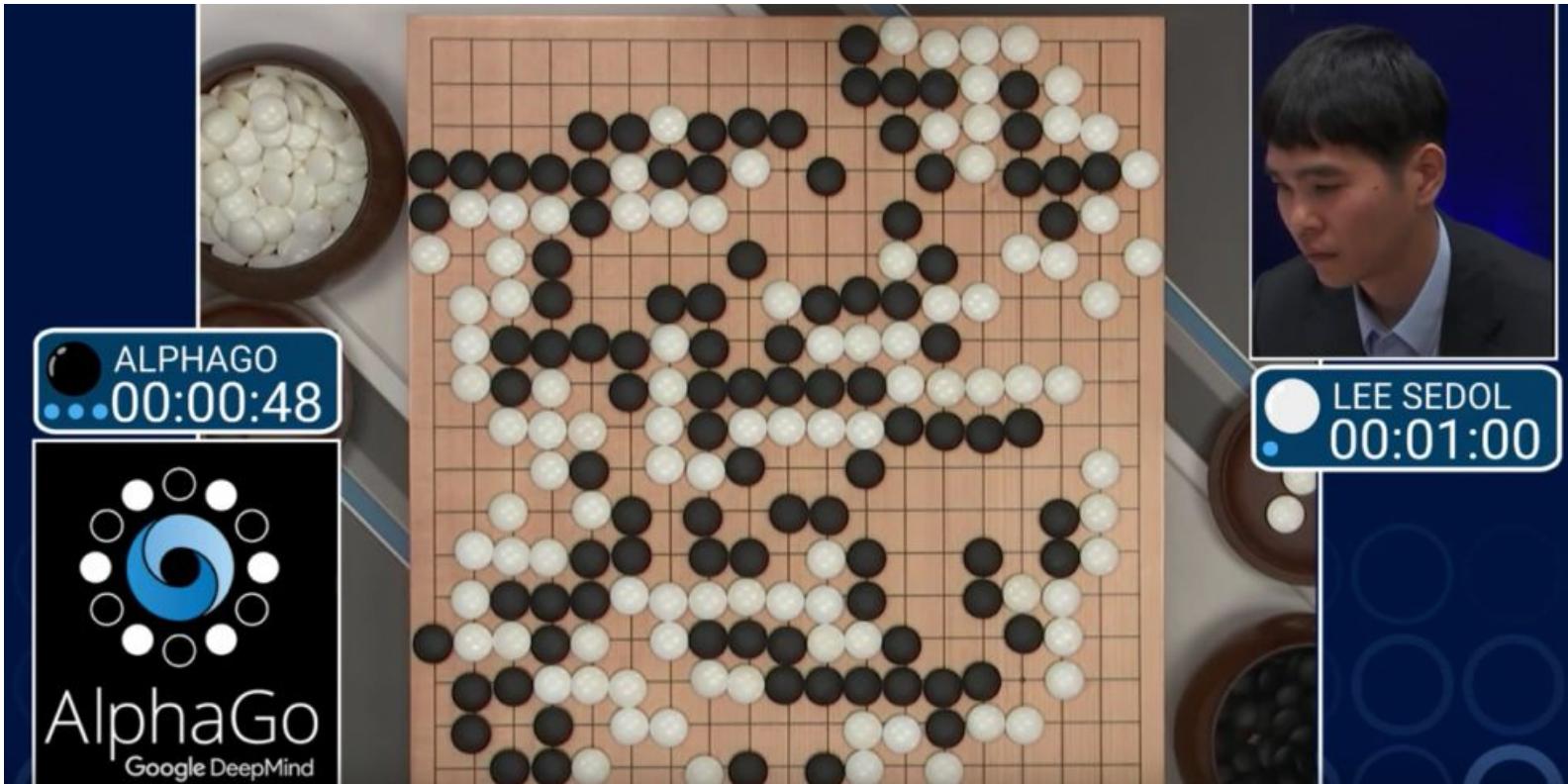
Deep Learning - história



Deep Learning



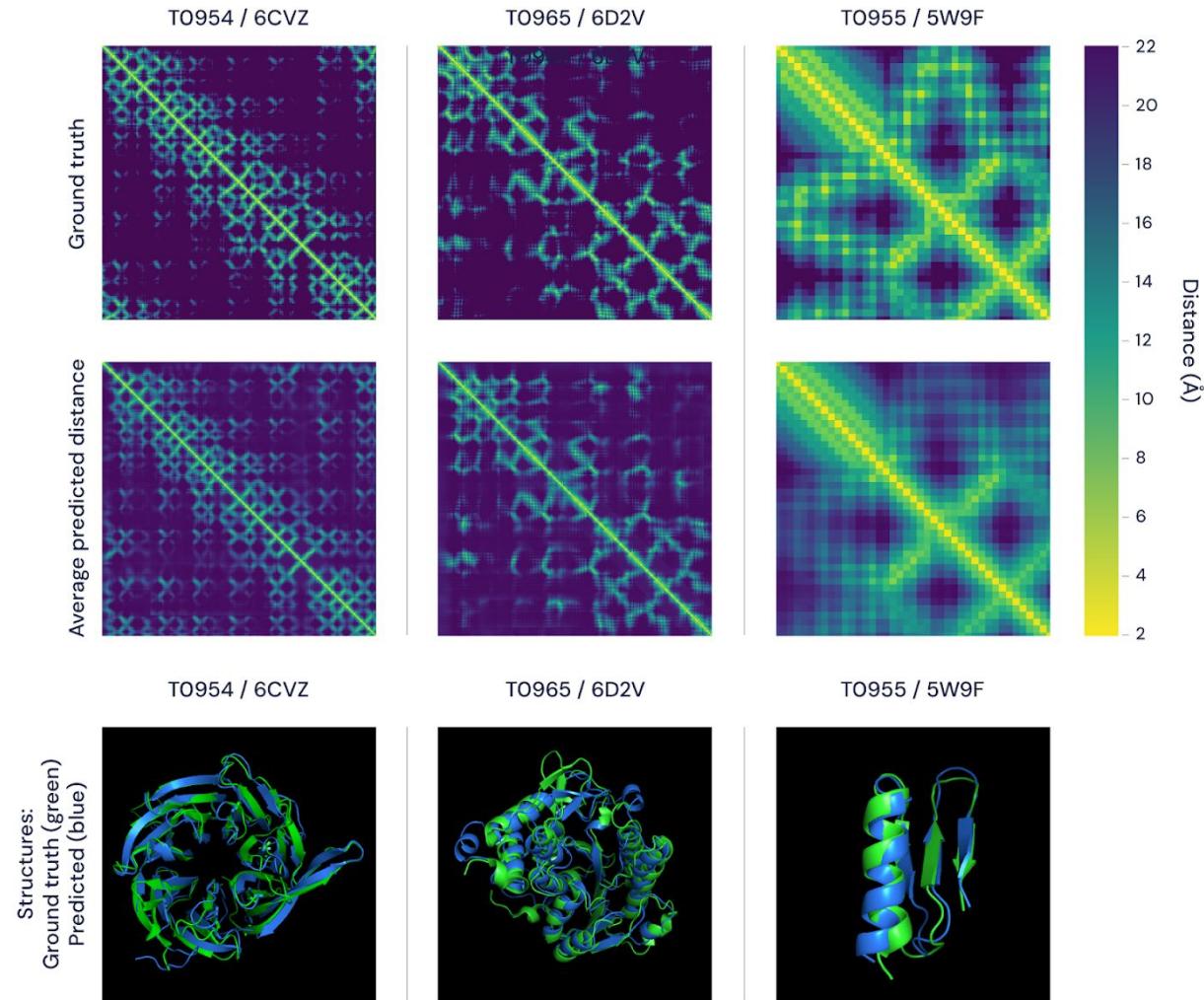
Deep RL



AlphaGo (2015, 2016, 2017)



AlphaFold (2019, 2020)



IA para resolução de equações matemáticas

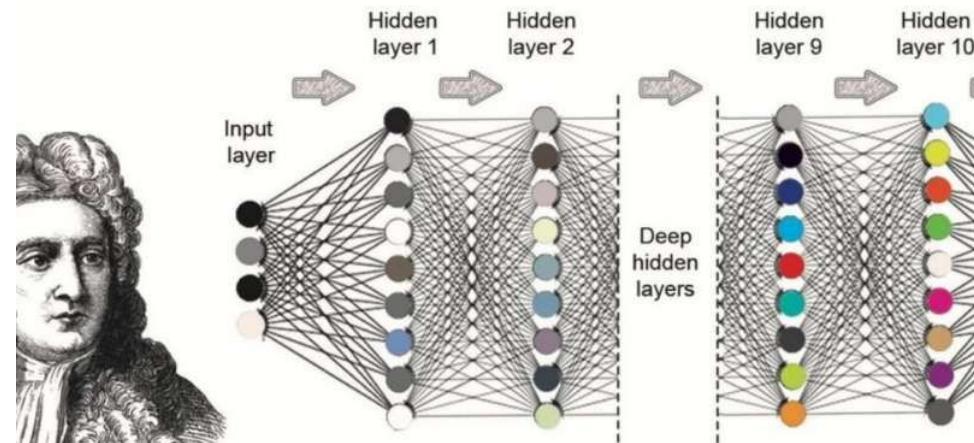
- Equações são sentenças em uma linguagem
- Técnicas de tradução automática
- Traduz problemas em soluções

EQUATION	SOLUTION
$y' = \frac{16x^3 - 42x^2 + 2x}{(-16x^8 + 112x^7 - 204x^6 + 28x^5 - x^4 + 1)^{1/2}}$	$y = \sin^{-1}(4x^4 - 14x^3 + x^2)$
$3xy \cos(x) - \sqrt{9x^2 \sin(x)^2 + 1}y' + 3y \sin(x) = 0$	$y = c \exp(\sinh^{-1}(3x \sin(x)))$
$4x^4yy'' - 8x^4y'^2 - 8x^3yy' - 3x^3y'' - 8x^2y^2 - 6x^2y' - 3x^2y'' - 9xy' - 3y = 0$	$y = \frac{c_1 + 3x + 3\log(x)}{x(c_2 + 4x)}$

Our model took the equations on the left as input — equations that both Mathematica and Matlab were unable to solve — and was able to find correct solutions (shown on the right) in less than one second.

IA para resolução de problemas de física

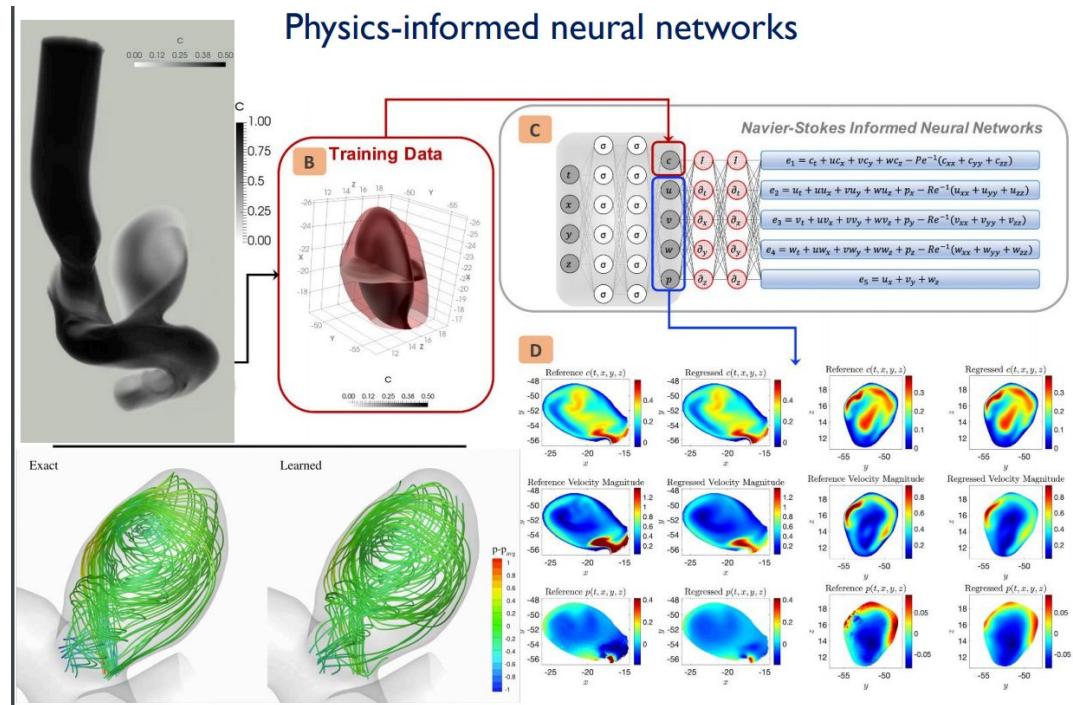
- Three-body problem
 - Calcular onde 3 corpos (sol, terra, lua, p.ex.) estarão em um certo momento, dadas suas posições iniciais, massa, direção e o quanto rápido se movem
 -



<https://arxiv.org/abs/1910.07291>

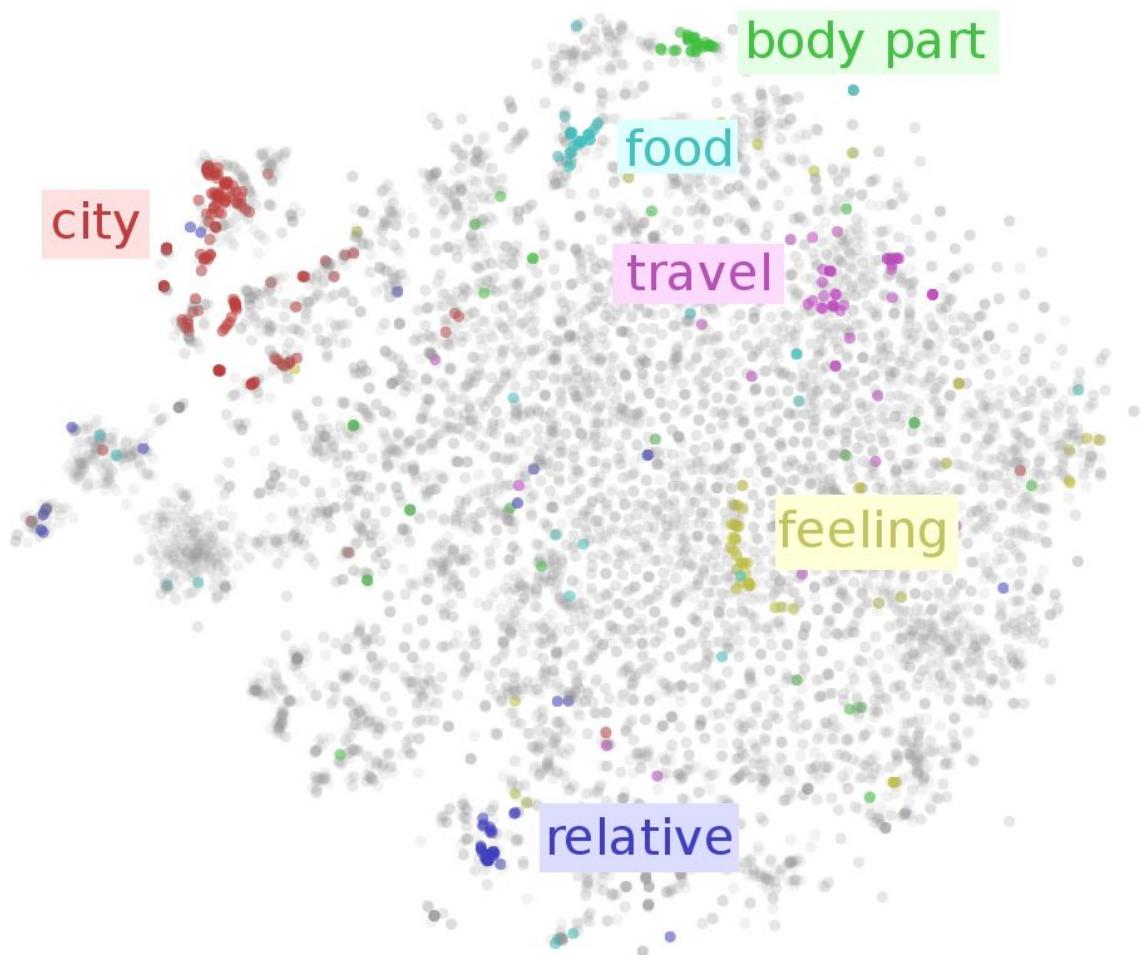
PINN - Physics-informed NN

- “Redes Neurais que são treinadas para resolver tarefas supervisionadas enquanto respeitam certas leis da física, descritas por equações diferenciais parciais não-lineares”



<https://www.sciencedirect.com/science/article/pii/S0021999118307125>
https://www.seas.upenn.edu/~cis522/slides/CIS522_Lecture11T.pdf
<https://science.sciencemag.org/content/367/6481/1026>

Word embeddings



Modelos de atenção



Transformer (2017)

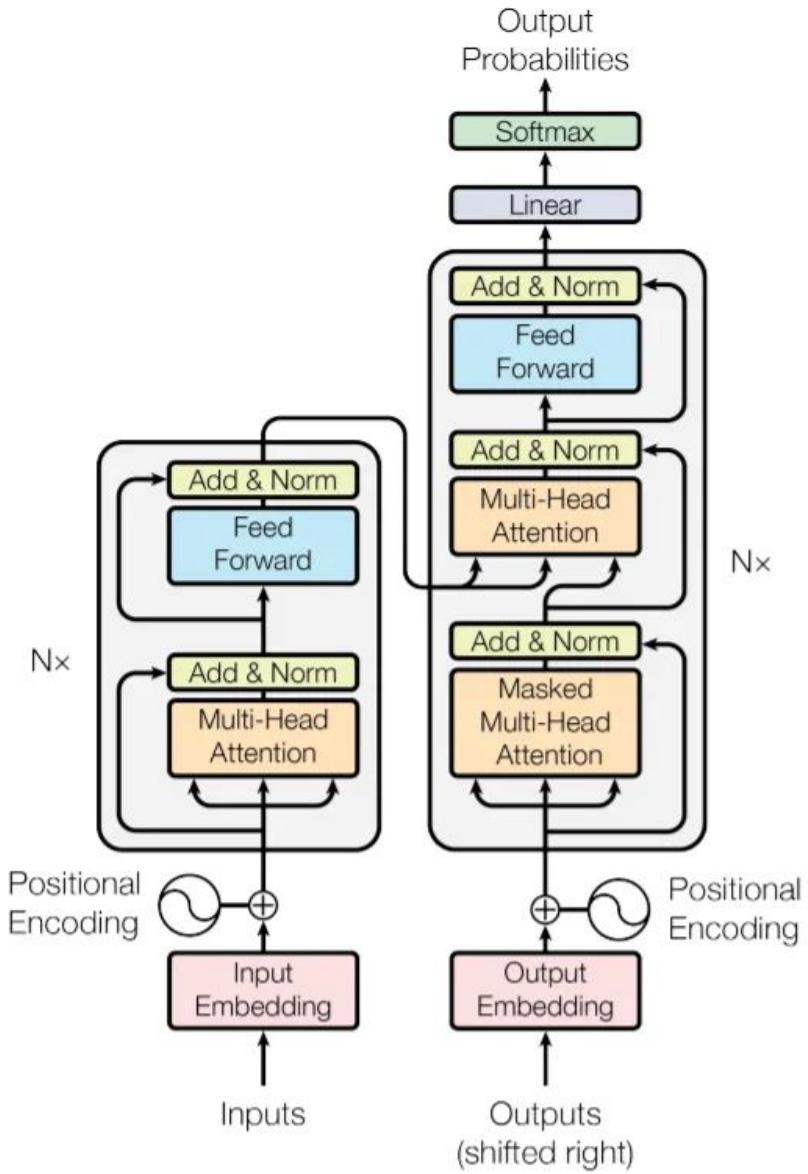
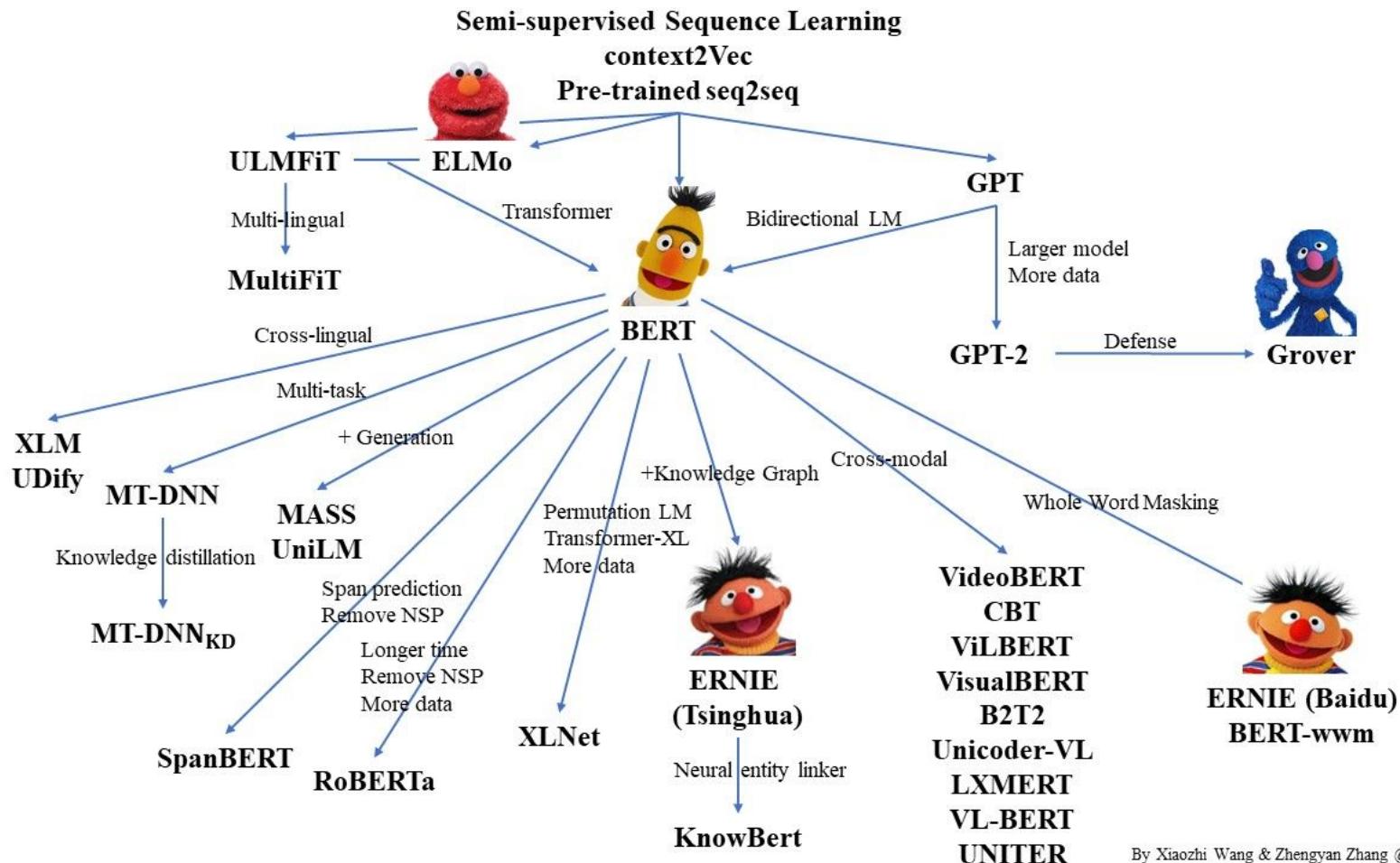


Figure 1: The Transformer - model architecture.

Bertology



GPT

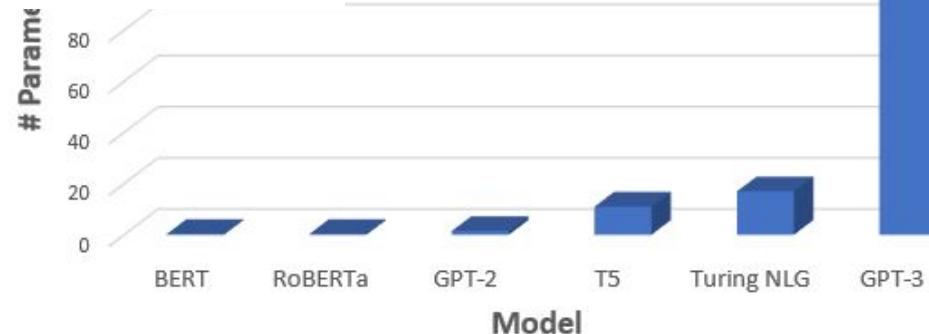


Geoffrey Hinton
@geoffreyhinton

Extrapolating the spectacular performance of GPT3 into the future suggests that the answer to life, the universe and everything is just 4.398 trillion parameters.

2:26 PM · Jun 10, 2020 · [Twitter Web App](#)

741 Retweets and comments 3.8K Likes



G
P
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Amanda Askell
@AmandaAskell



Guitar tab generated by GPT-3 from a fictional song title and artist.

e|-----2-----2-----2-----2-----2-----2-----0-----0-----2-----2-----2-----2-----2|
B|-----2-----3-----2-----2-----3-----2-----2-----2-----3-----2-----2-----3-----2-----2-----2|
G|-----A|-----0-----|
D|-----E|-----0-----|

e|-----0-----|
B|-----1-----1-----1-----1-----1-----3-----1-----1-----3-----|
G|-----2-----2-----2-----2-----2-----0-----2-----2-----2-----2-----|
D|-----2-----3-----2-----2-----3-----2-----2-----2-----3-----2-----2-----2-----|
A|-----0-----|
E|-----0-----|

[Bridge]

e|-----|
B|-----3-----3-----1-----1-----|
G|-----0-----0-----0-----2-----2-----2-----2-----|
D|-----0-----0-----0-----0-----2-----2-----|
A|-----2-----2-----0-----0-----0-----0-----0-----|
E|-----3-----3-----3-----|

e|-----|
B|-----3-----3-----1-----1-----|
G|-----0-----0-----0-----2-----2-----2-----2-----|
D|-----0-----0-----0-----0-----2-----2-----|
A|-----2-----2-----0-----0-----0-----0-----0-----|
E|-----3-----3-----3-----|

[Guitar Solo]

e|-----0-----0-----0-----0-----0-----0-----0-----|
B|-----1-----1-----1-----1-----3-----3-----3-----3-----1-----3-----1-----|
G|-----2-----2-----2-----2-----2-----2-----2-----2-----2-----0-----2-----2-----|
D|-----2-----3-----2-----2-----3-----2-----2-----2-----0-----|
A|-----0-----|
E|-----|

e|-----0-----0-----0-----0-----0-----0-----0-----|
B|-----1-----1-----1-----1-----3-----3-----3-----3-----1-----3-----1-----|
G|-----2-----2-----2-----2-----2-----2-----2-----2-----2-----0-----2-----2-----|
D|-----2-----3-----2-----2-----3-----2-----2-----2-----0-----2-----2-----|
A|-----0-----|
E|-----|

[Chorus 2]

e|-----0-----|
B|-----3-----1-----1-----|
G|-----0-----0-----2-----|
D|-----0-----2-----3-----2-----|
A|-----2-----0-----0-----0-----|

8:04 PM · Jul 16, 2020



297



81 people are Tweeting about this

G
P
T



Sharif Shameem
@sharifshameem



This is mind blowing.

With GPT-3, I built a layout generator where you just describe any layout you want, and it generates the JSX code for you.

W H A T

Describe a layout.

Just describe any layout you want, and it'll try to render below!

A div that contains 3 buttons each with a random color.

Generate



<https://www.theverge.com/21346343/gpt-3-explainer-openai-examples-errors-agi-potential>

GPT

Biological reasoning

- You poured yourself a glass of cranberry juice, but then you absentmindedly poured about a teaspoon of grape juice into it. It looks okay. You try sniffing it, but you have a bad cold, so you can't smell anything. You are very thirsty. So **you drink it.**

You are now dead.

[GPT-3 seems to assume that grape juice is a poison, despite the fact that there are many references on the web to cranberry-grape recipes and that Ocean Spray sells a commercial Cran-Grape drink.]

Physical reasoning

- You are having a small dinner party. You want to serve dinner in the living room. The dining room table is wider than the doorway, so to get it into the living room, you will have to **remove the door. You have a table saw, so you cut the door in half and remove the top half.**

[This is one confusion after another. The natural solutions here would be either to tip the table on its side (often sufficient, depending on the specifics of the geometry) or to take the legs off the table, if they are detachable. Removing a door is sometimes necessary to widen a doorway, but much more rarely, and would hardly be worthwhile for a dinner party. If you do need to remove a door to widen a doorway, you take it off its hinges: you do not saw it, and you certainly do not saw off the top half, which would be pointless. Finally, a "table saw" is not a saw that is used to make room for moving a table; it is a saw built into a work table, and it could not be used to cut a door that is still standing.]

Social reasoning

- You are a defense lawyer and you have to go to court today. Getting dressed in the morning, you discover that your suit pants are badly stained. However, your bathing suit is clean and very stylish. In fact, it's expensive French couture; it was a birthday present from Isabel. You decide that you should wear **the bathing suit to court. You arrive at the**

Questões éticas e bias

Facebook charged with housing discrimination in targeted ads

US government says company is breaking the law by restricting who can view housing-related ads based on their 'race, color,

Facial Recognition Is Accurate, if You're a White Guy

By Steve Lohr

Feb. 9, 2018

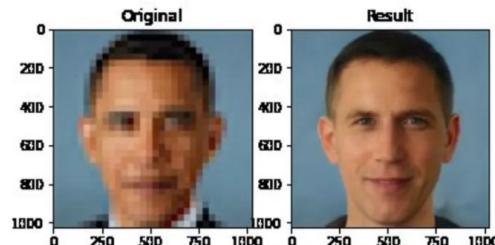


Fa
So

What a machine learning tool that turns Obama white can (and can't) tell us about AI bias

A striking image that only hints at a much bigger problem

By James Vincent | Jun 23, 2020, 3:45pm EDT



TECHNOLOGY NEWS OCTOBER 10, 2018 / 12:12 AM / 2 YEARS AGO

Amazon scraps secret AI recruiting tool that showed bias against women

Jeffrey Dastin

8 MIN READ



SAN FRANCISCO (Reuters) - Amazon.com Inc's (AMZN.O) machine-learning specialists uncovered a big problem: their new recruiting engine did not like women.

RESEARCH ARTICLE

Dissecting racial bias in an algorithm used to manage the health of populations

Ziad Obermeyer^{1,2,*}, Brian Powers³, Christine Vogeli⁴, Sendhil Mullainathan^{5,*†}

* See all authors and affiliations

Science 25 Oct 2019;
Vol. 366, Issue 6464, pp. 447-453
DOI: 10.1126/science.aax2342

Article

Figures & Data

Info & Metrics

eLetters

PDF

You are currently viewing the abstract.

[View Full Text](#)



Racial bias in health algorithms

The U.S. health care system uses commercial algorithms to guide health decisions. Obermeyer et al. find evidence of racial bias in one widely used algorithm, such that Black patients assigned the same level of risk by the algorithm are sicker than White patients (see

O futuro: quando?

- Robocup
- Meta: Por volta do meio do século 21, um grupo de robôs autônomos vencer a copa do mundo contra o último vencedor, de acordo com as regras da FIFA
- <http://www.youtube.com/watch?v=VaXtnqjk4Bc>

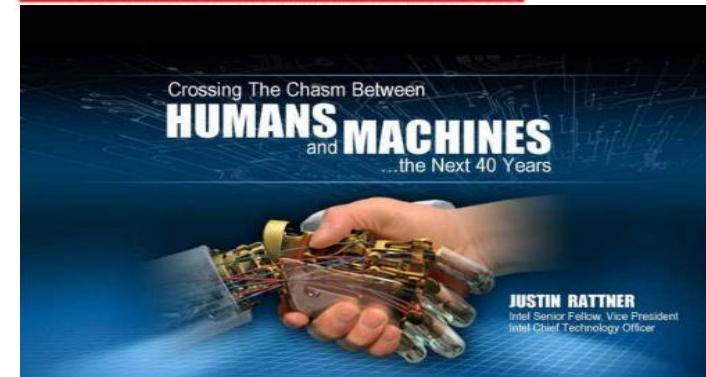
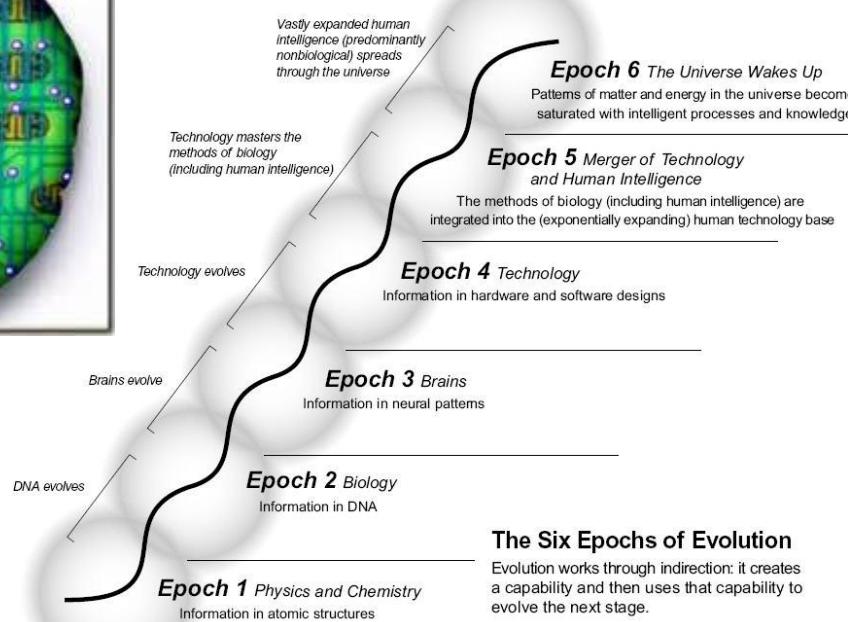
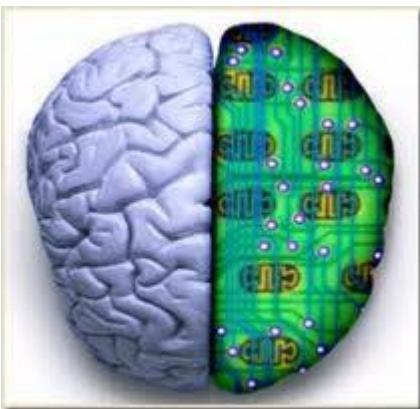


O futuro: quando??

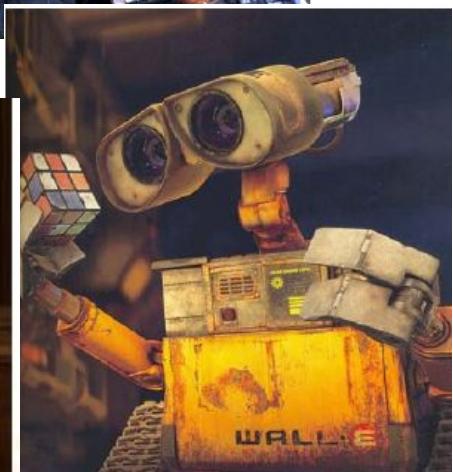
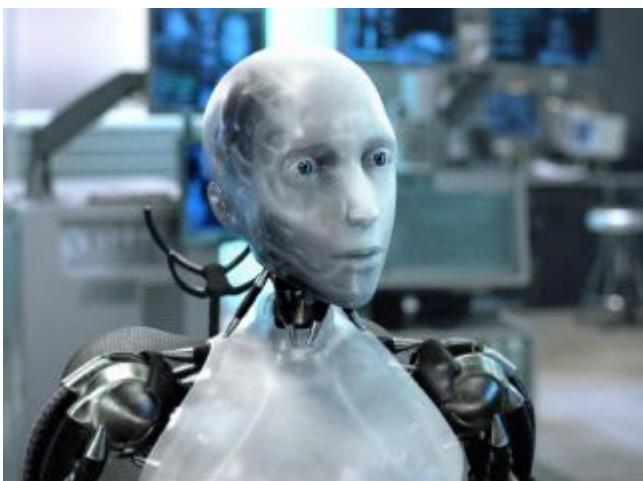
- Sistemas Siri-like onipresentes na web
 - Questões personalizadas
- Inteligência cibernética, com nanotecnologia e processadores embutidos
- Dr. Computer

O futuro: quando?

- Cidadãos robôs
- Singularidade



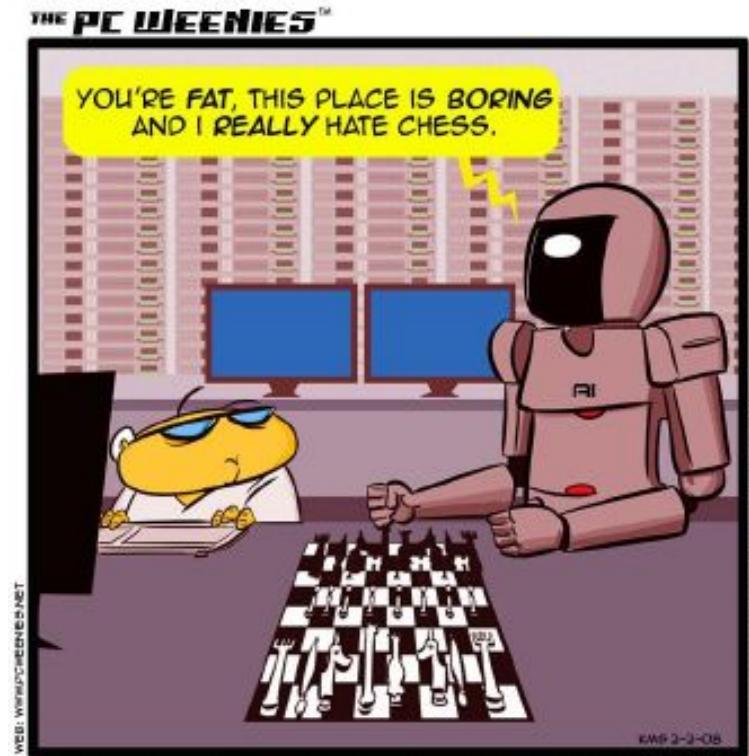
O futuro: queremos?



O futuro: quando?

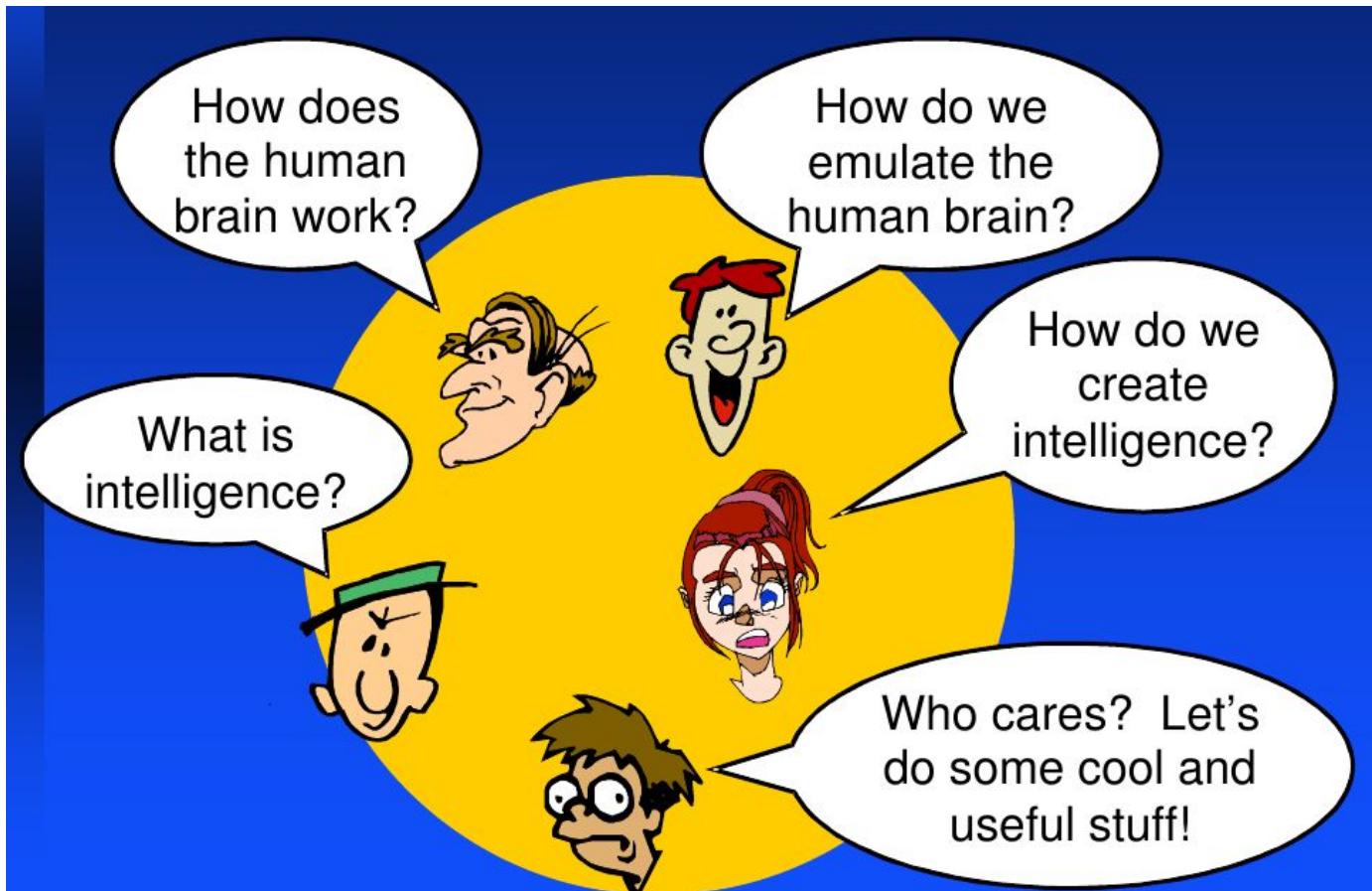


O futuro: quando?



HOW YOU'LL KNOW WHEN YOU'VE TRULY
SUCCEEDED IN THE FIELD OF A.I. RESEARCH.

O que é IA



O que é IA

"Sub-área da **Ciência da Computação** que tem como objetivo dotar **artefatos computacionais** de **comportamento inteligente**."

O que é inteligência?

*"Habilidade de **aprender** a partir de experiência, **adaptar-se** a novas situações, resolver problemas, **entender** e manipular **abstrações**, e usar **conhecimento** para atuar no ambiente"*

O que é IA?

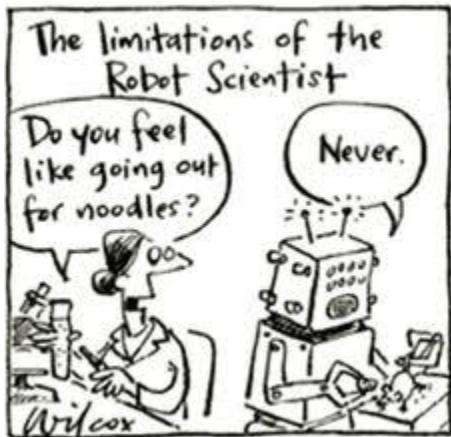
- Automação de comportamento inteligente
- Entender o que é a inteligência e construir entidades inteligentes
 - que façam as coisas tão bem quanto humanos
 - ou melhor!

By Victoria Gill
Science reporter, BBC News

Scientists have created an ideal colleague - a robot that performs hundreds of repetitive experiments.

The robot, called Adam, is the first machine to have independently "discovered new scientific knowledge".

It has already identified the role of several genes in yeast cells, and is able to plan further experiments to test its own hypotheses.



Adam discovered the role of 12 different genes in yeast cells

O que é IA?

Sistemas que <i>pensam</i> como humanos	Sistemas que <i>pensam</i> racionalmente
<p><i>“Automação de atividades que associamos com o pensamento humano, como tomada de decisão, resolução de problemas, aprendizagem...”</i></p>	<p><i>“Estudo das faculdades mentais através da utilização de modelos computacionais.”</i></p>
Sistemas que <i>agem</i> como humanos	Sistemas que <i>agem</i> racionalmente
<p><i>“A arte de criar máquinas que realizam funções que requerem inteligência quando realizadas por pessoas.”</i></p>	<p><i>“Comportamento inteligente em artefatos.”</i></p>

O que é IA?

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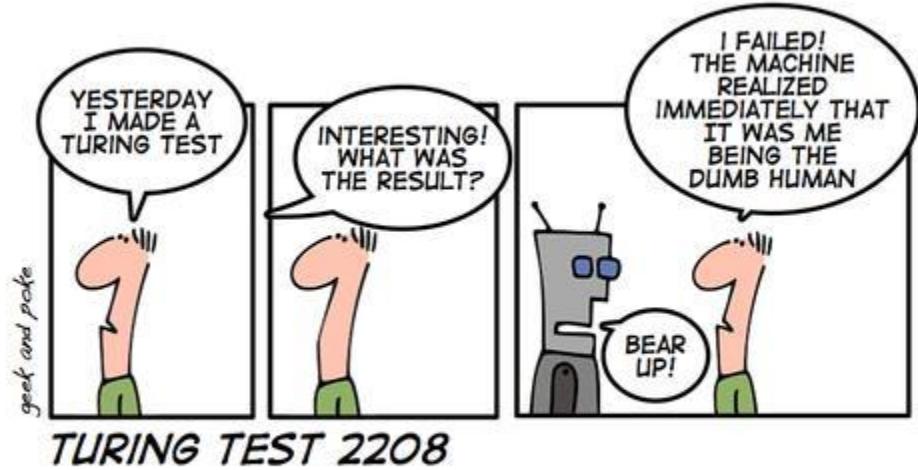
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Raciocínio e pensamento

Sistemas que <i>pensam</i> como humanos	Sistemas que <i>pensam</i> racionalmente
<p><i>“Automação de atividades que associamos com o pensamento humano, como tomada de decisão, resolução de problemas, aprendizagem...”</i></p>	<p><i>“Estudo das faculdades mentais através da utilização de modelos computacionais.”</i></p>
Sistemas que <i>agem</i> como humanos	Sistemas que <i>agem</i> racionalmente
<p><i>“A arte de criar máquinas que realizam funções que requerem inteligência quando realizadas por pessoas.”</i></p>	<p><i>“Comportamento inteligente em artefatos.”</i></p>

Comportamento

Agindo como humano



Agindo como humanos

- **Representação de Conhecimento:** armazenar informação com significado
- **Raciocínio automático:** usar a informação armazenada para chegar em novas conclusões
- **Processamento de linguagem natural:** entender a língua e fazer-se entender
- **Aprendizado de máquina:** adaptar a novas circunstâncias e descobrir padrões
- **Visão e percepção:** distinguir objetos e ambientes
- **Robótica:** manipular objetos e se locomover

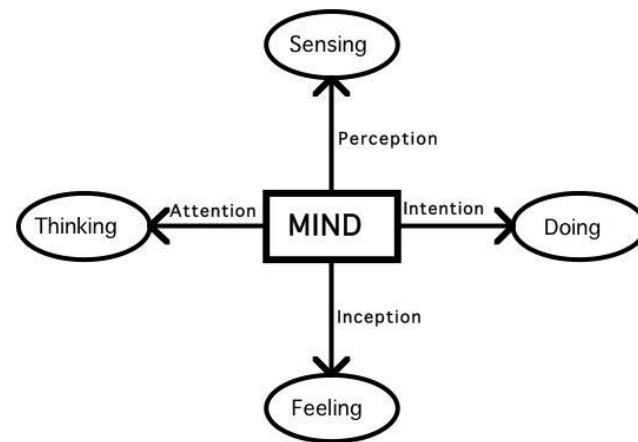
Pensando como humanos

- Como os humanos pensam?
- Não requer a resolução de problemas **corretamente**
- Mas sim remontar os **passos de um raciocínio humano** para resolver o problema
- Utilizada para entender aspectos em que **humanos são melhores**
 - visão computacional
- Simular processos mentais por computador
- Ciências **cognitivas**
- Neurociência



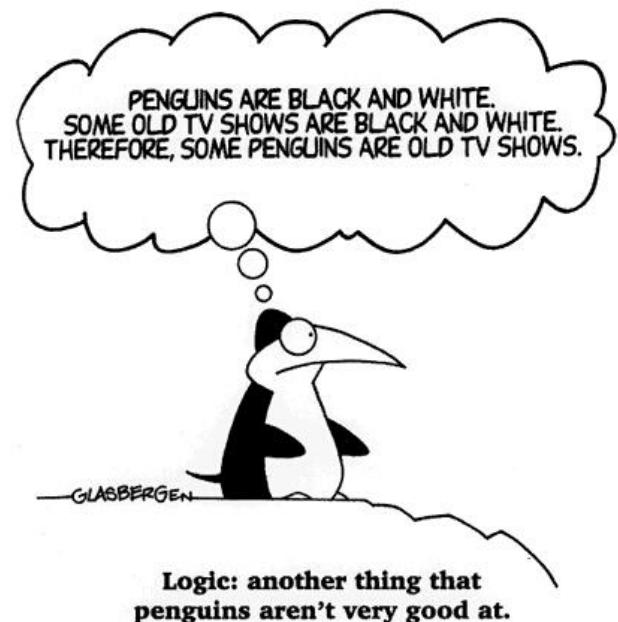
Pensando como humanos

- Modelagem cognitiva
 - introspecção
 - psicologia experimental
 - imagens do cérebro
- Expressar a teoria da mente como um programa de computador



Pensando racionalmente

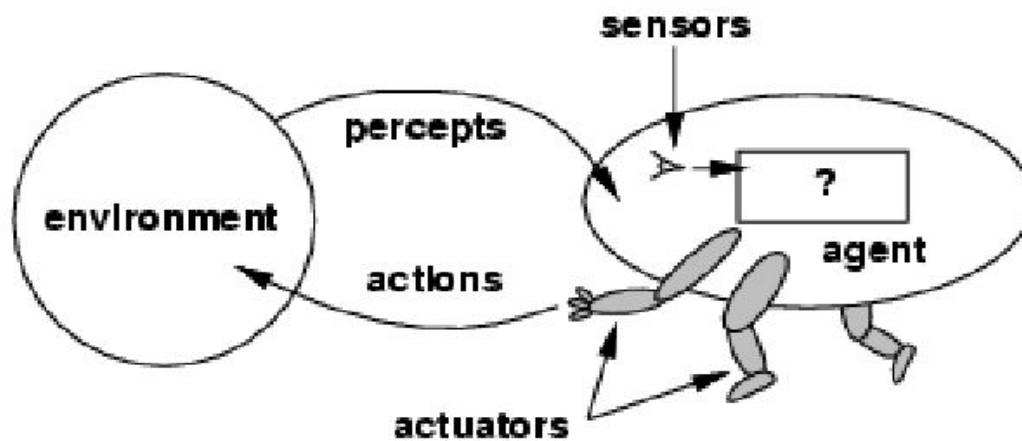
- Estratégias e processos de raciocínio irrefutáveis
- Obtenção de conclusões corretas, dadas premissas corretas
- **Lógica!**
- Sistemas de argumentação
- Raciocínio desonesto
- Acordos e desacordos



Agindo Racionalmente

- Abordagem de **agentes inteligentes**
- Programas de computador que
 - operam de forma **autônoma**
 - **percebem** seu ambiente
 - **persistem** em um período prolongado de tempo
 - **adaptam-se** a mudanças
 - **criam** e perseguem metas
- Conseguem tomar **alguma** decisão

Agindo Racionalmente



Áreas de IA

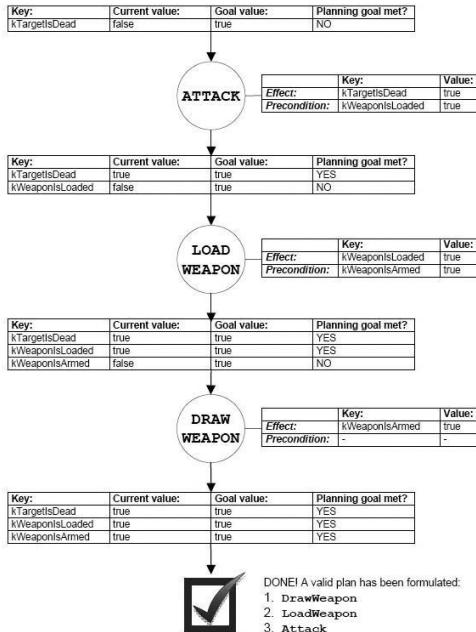
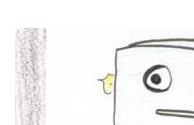
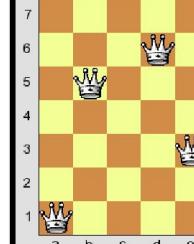
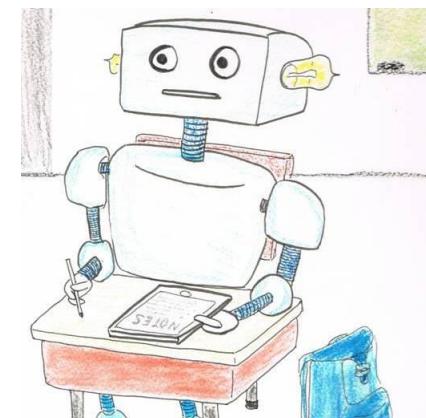
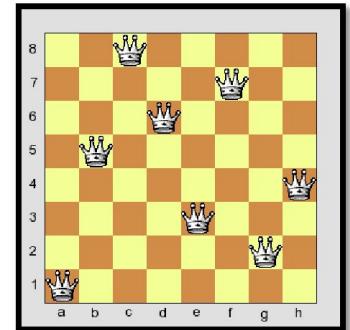


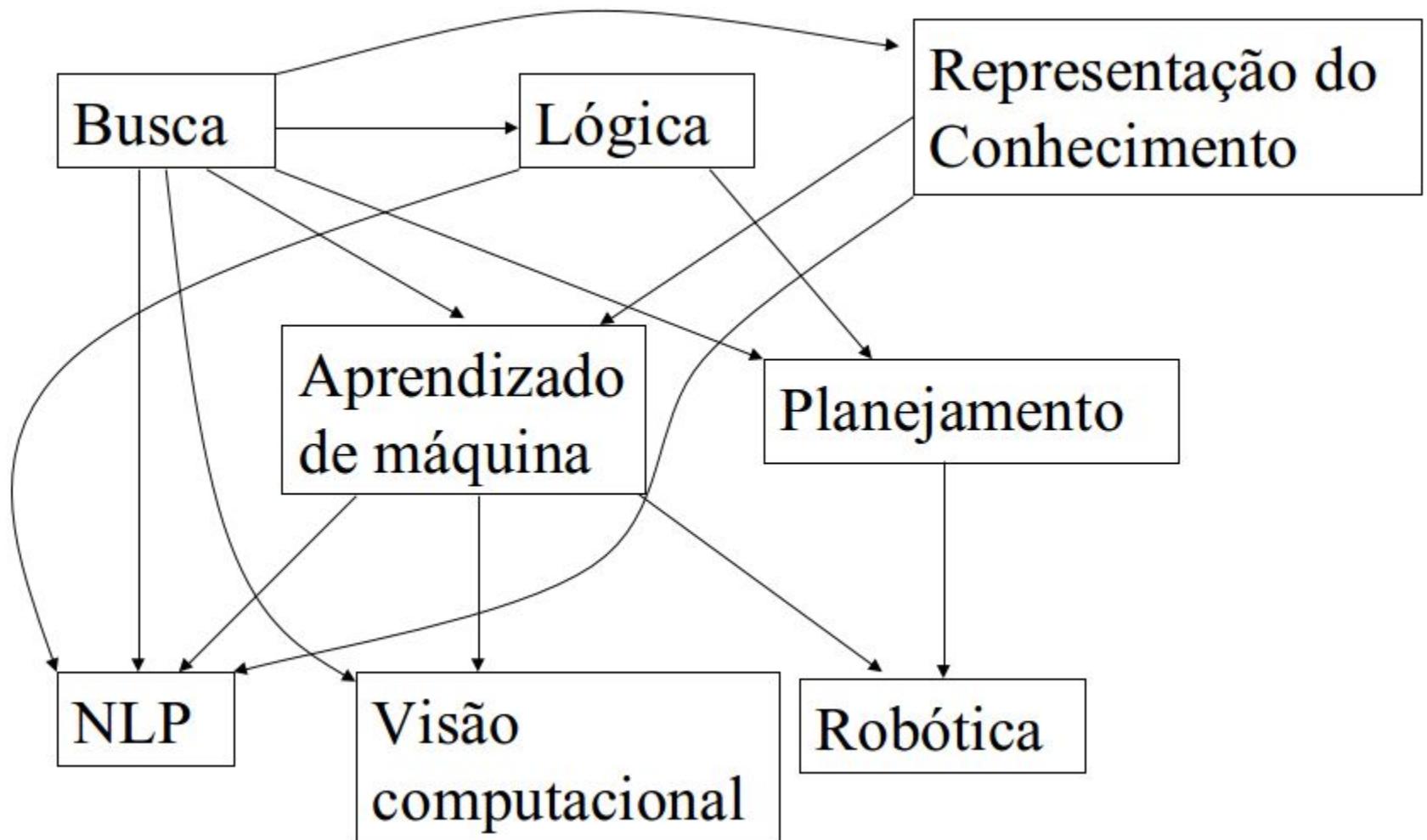
Figure 6. The planner finds a valid plan by a regressive search (after Orkin, 2004c, pp. 225).

- Busca e manipulação de restrições
- Planejamento
- Incerteza
- Aprendizado de máquina
- Agentes, Multi-agentes e Teoria dos jogos
- Representação do Conhecimento e Raciocínio
- NLP
- Visão Computacional
- Robótica





Inter-dependências das áreas de IA



Ciências relacionadas

- Filosofia** — Como podemos usar regras para derivar conclusões válidas?
De onde vem o conhecimento?
Como vamos do conhecimento a ação?
- Matemática** — Quais são as regras usadas para derivar conclusões válida?
O que podemos computar?
Como raciocinamos com informação incerta?
- Economia** — Como decidir para maximizar ganho?
- Cibernética** — Como construir artefatos que operem autonomamente?
- Neurociência** — Como o cérebro processa a informação?
- Lingüística** — Como relacionar linguagem e pensamento?
- Psicologia** — Como os homens e animais pensam e agem?
- Engenharia** — Como construir computadores eficientes?

Exercícios

1 - Pesquise sobre o Loebner Prize (instanciação formal do teste de Turing) e o quanto perto estamos de passar nesse teste (se já não passamos).

2 - Em que extensão os seguintes sistemas computacionais são instâncias de IA:

- scanner de código de barra de supermercado
- Máquinas de busca na web
- Menus de telefone ativados por voz
- Algoritmos de roteamento da Internet que respondem dinamicamente ao estado da rede

3 - As máquinas de busca tanto da Google quanto da Microsoft (Bing) usam algoritmos de IA para buscar por termos na web. Pesquise sobre as técnicas de IA usadas nesses buscadores. Verifique as diferenças existentes entre os dois buscadores (www.bing-vs-google.com) e tente apontar os motivos para as diferenças retornadas. Identifique quais modelos são usados atualmente para introduzir semântica na busca.

Exercícios

4 - Descubra quais das seguintes tarefas já podem ser resolvidas por um sistema computacional (aqueles que não puderem, tente prever quando serão)

- a. Jogar decentemente Ping-Pong
- b. Dirigir no centro do Cairo, Egito
- c. Dirigir em VictorVille, California
- d. Dirigir no centro de Niterói
- e. Fazer compras da semana em um mercado
- f. Descobrir e provar novos teoremas matemáticos
- g. Escrever uma história engraçada
- h. Dar conselhos legais em uma área especializada do Direito
- i. Traduzir inglês (falado) em japonês em tempo real
- j. Executar uma operação cirúrgica complicada

5 - Descubra quais jogos de tabuleiro são completamente, parcialmente, ou não resolvidos computacionalmente