

"UMA CONVERSA SOBRE FICÇÃO CIENTÍFICA"

24
ABRIL
19:00
IAGUSP



**ANTÔNIO
XERXESKY**



**RODRIGO
NEMMEN**



**EDUARDO
CYPRIANO**

VAGAS LIMITADAS!
INSCRIÇÕES 10/04 - 08:00:
WWW.EVENTOS.IAG.USP.BR

**ENCONTRO
DE
CONFERENCISTAS**



IAG
INSTITUTO DE
ASTRONOMIA,
GEOFÍSICA
E CIÊNCIAS
ATMOSFÉRICAS

Sci-fi na perspectiva de um astrofísico

Rodrigo Nemmen

Universidade de São Paulo

blackholegroup.org

 @nemmen

Sci-fi na perspectiva de um astrofísico

Rodrigo Nemmen

Universidade de São Paulo

blackholegroup.org

 @nemmen

**Vivemos numa era de
ficção científica**

Debate ético sobre manter vivos cérebros de porcos sem o corpo

By Pallab Ghosh
Science correspondent, BBC News

🕒 27 April 2018

[f](#) [🐦](#) [💬](#) [✉](#) [Share](#)



REUTERS

The scientists used pumps, heaters, and bags of artificial blood to restore circulation to the pig brains

Researchers at Yale University have restored circulation to the brains of decapitated pigs, and kept the organs alive for several hours.

Debate ético sobre manter vivos cérebros de porcos sem o corpo

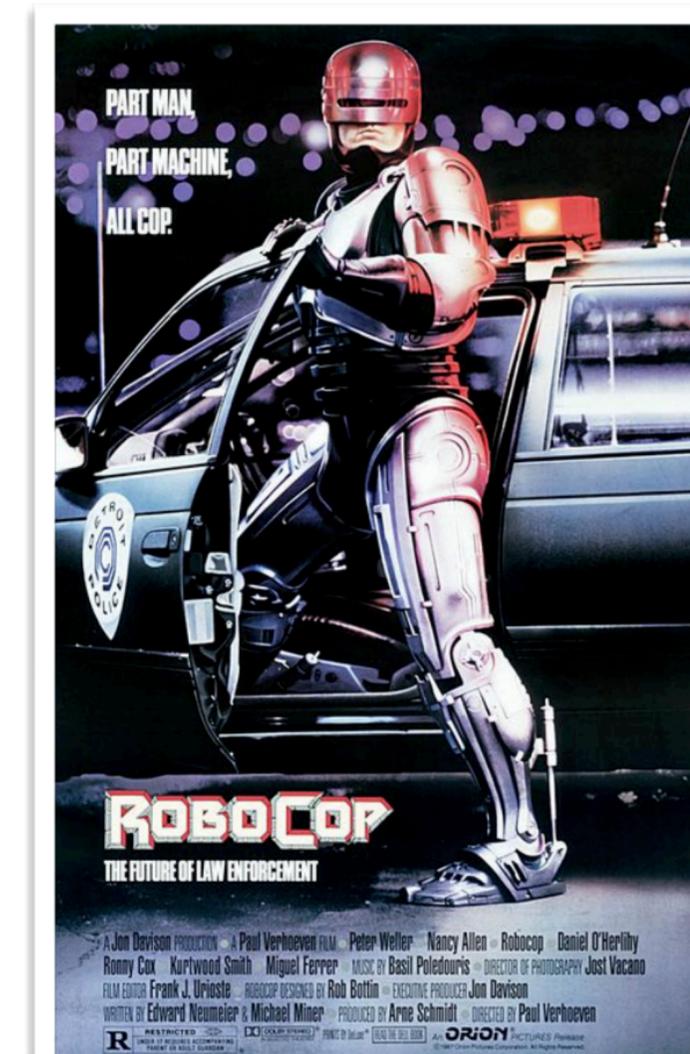
By Pallab Ghosh
Science correspondent, BBC News

🕒 27 April 2018

[f](#) [🐦](#) [💬](#) [✉](#) [Share](#)



Researchers at Yale University have restored circulation to the brains of decapitated pigs, and kept the organs alive for several hours.



Debate ético sobre manter vivos cérebros de porcos sem o corpo

By Pallab Ghosh
Science correspondent, BBC News

🕒 27 April 2018

[f](#) [t](#) [m](#) [e](#) [Share](#)



REUTERS

The scientists used pumps, heaters, and bags of artificial blood to restore circulation to the pig brains

Researchers at Yale University have restored circulation to the brains of decapitated pigs, and kept the organs alive for several hours.

Startup diz que backup de cérebros vai causar a morte dos usuários



Dave Lee
North America technology reporter

🕒 14 March 2018 | [f](#)

[f](#) [t](#) [m](#) [e](#) [Share](#)



GETTY IMAGES

There is no proof that memories can be retrieved from a dead brain

A start-up that claims it will one day allow people to back-up their brains admits it will come at the ultimate price: death.

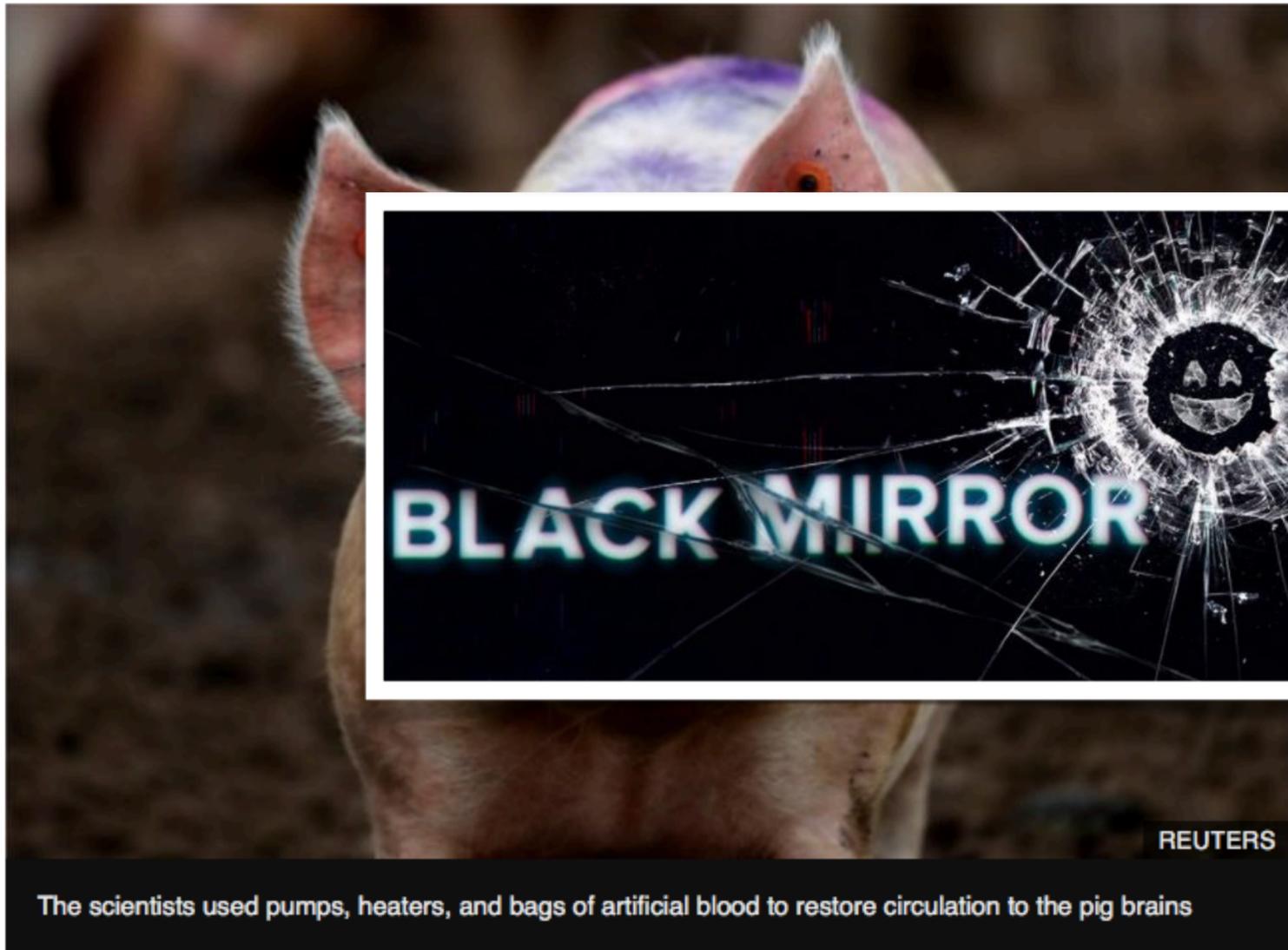
R. Nemmen

Debate ético sobre manter vivos cérebros de porcos sem o corpo

By Pallab Ghosh
Science correspondent, BBC News

🕒 27 April 2018

[f](#) [t](#) [m](#) [e](#) [Share](#)



The scientists used pumps, heaters, and bags of artificial blood to restore circulation to the pig brains

Researchers at Yale University have restored circulation to the brains of decapitated pigs, and kept the organs alive for several hours.

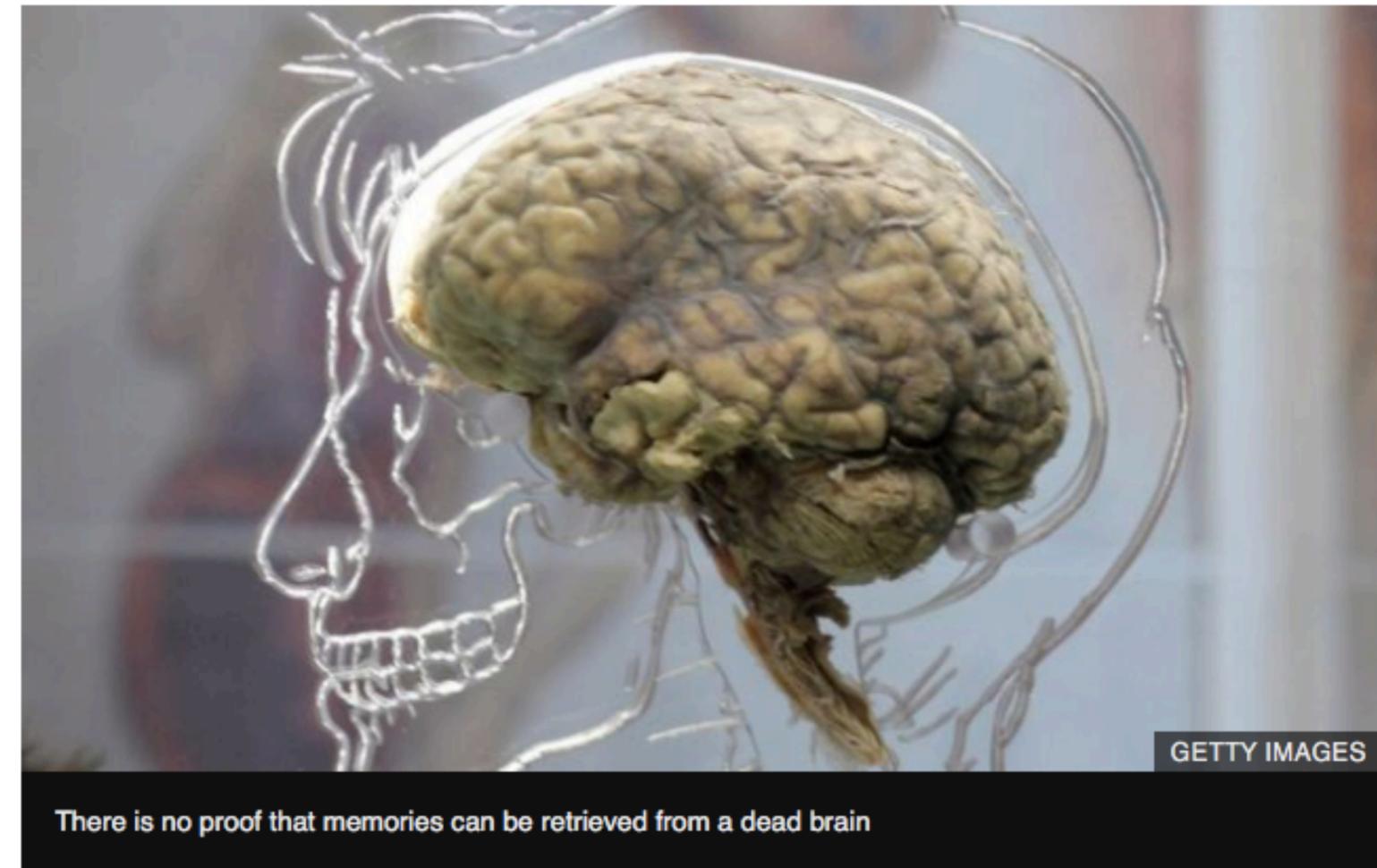
Startup diz que backup de cérebros vai causar a morte dos usuários



Dave Lee
North America technology reporter

🕒 14 March 2018 | [f](#)

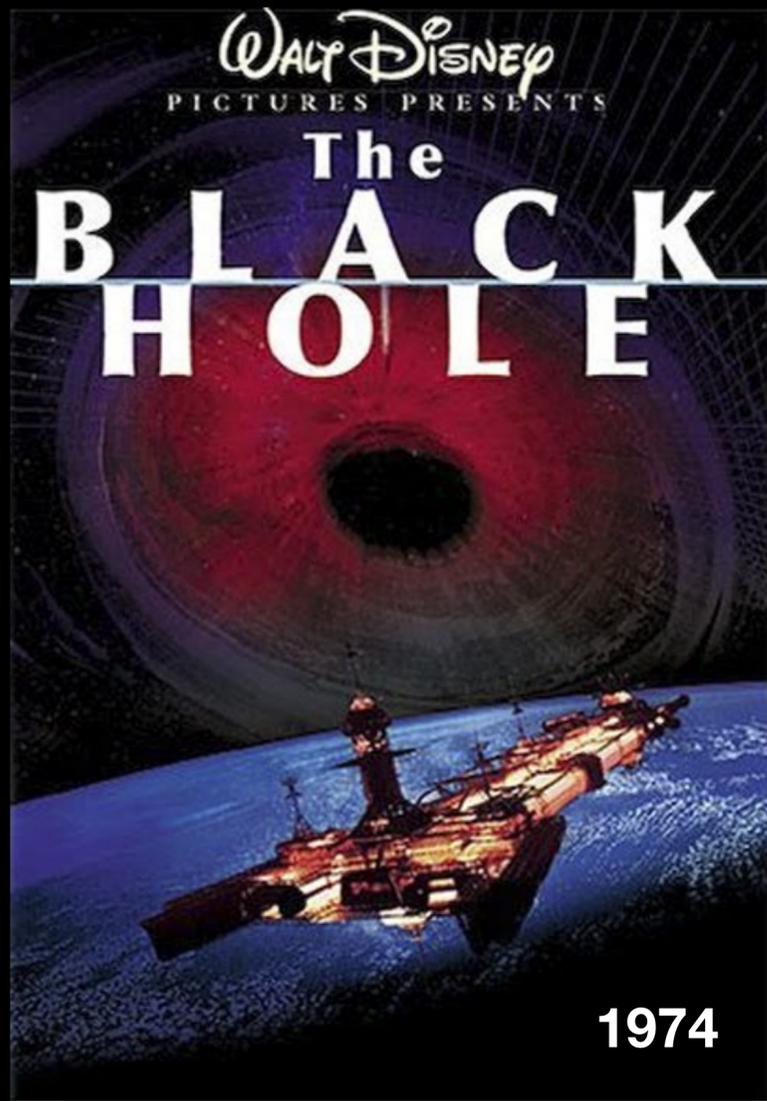
[t](#) [m](#) [e](#) [Share](#)

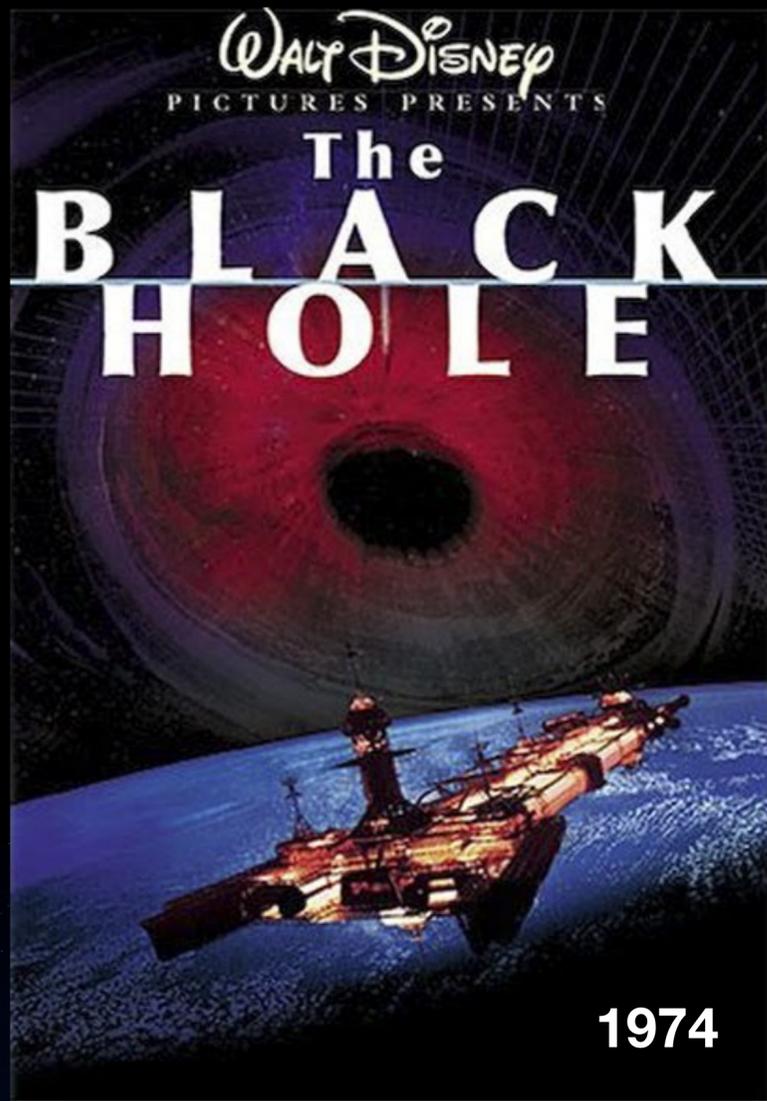


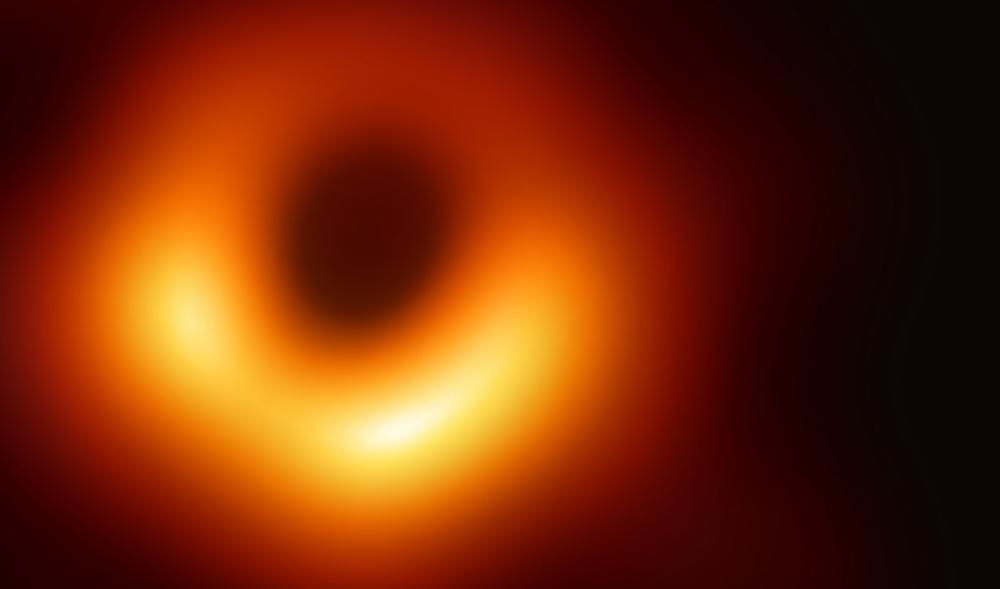
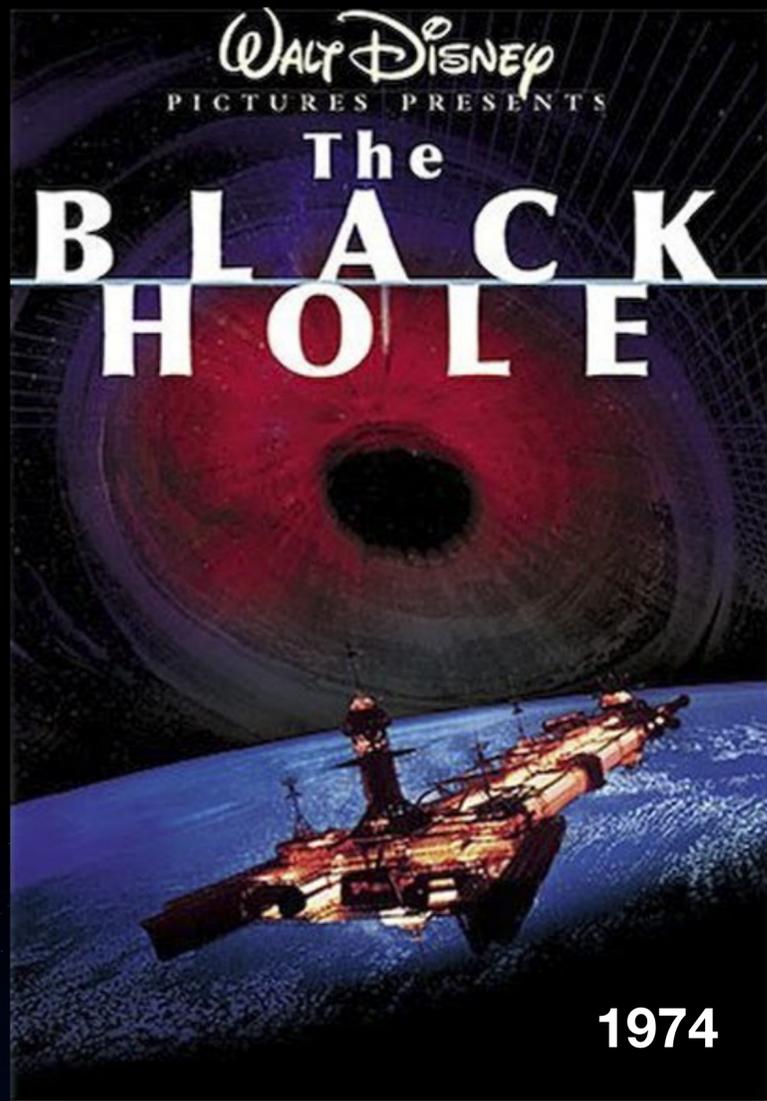
There is no proof that memories can be retrieved from a dead brain

A start-up that claims it will one day allow people to back-up their brains admits it will come at the ultimate price: death.

R. Nemmen







Tópicos de sci-fi



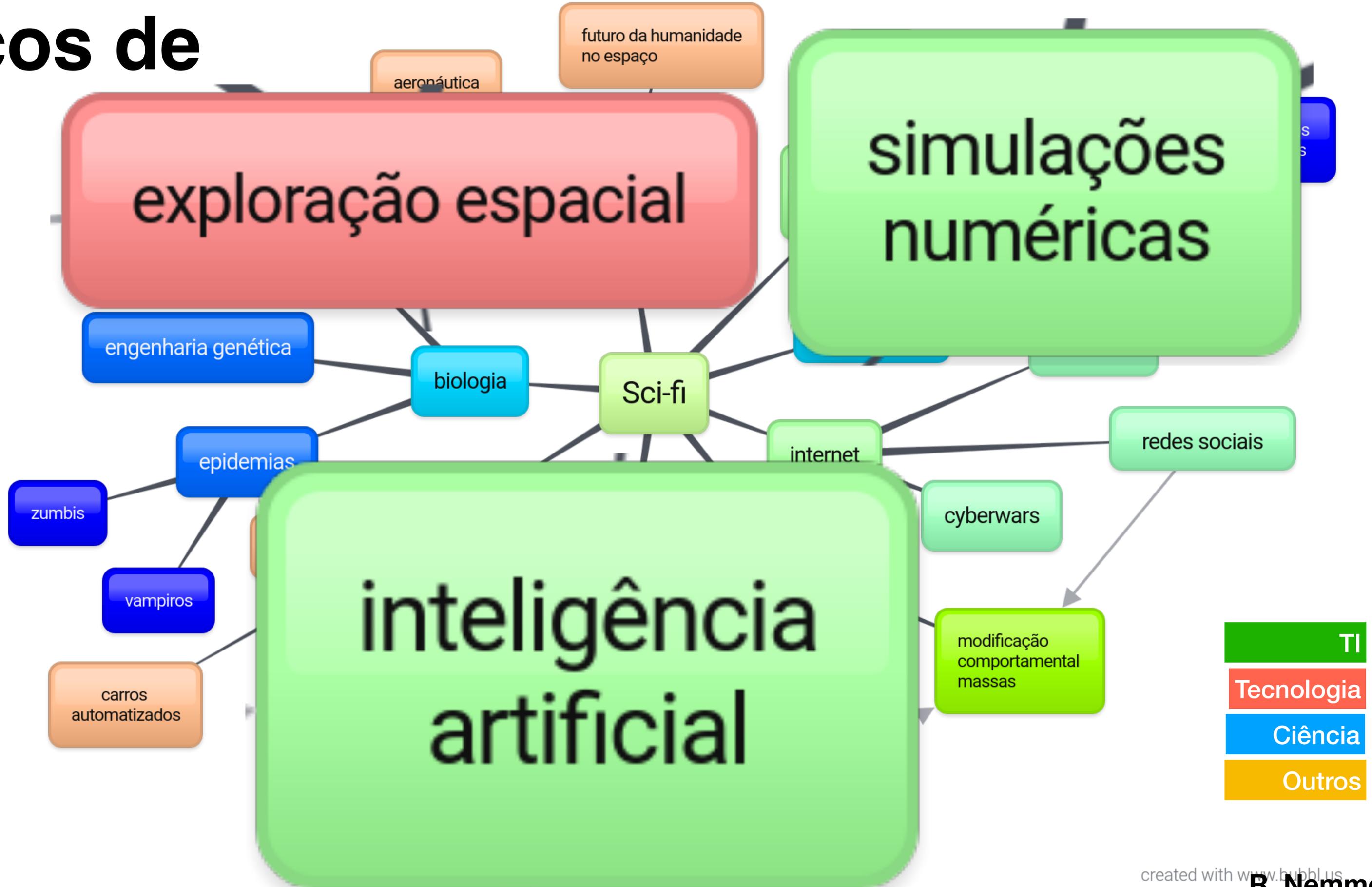
- TI
- Tecnologia
- Ciência
- Outros

Tópicos de sci-fi



- TI
- Tecnologia
- Ciência
- Outros

Tópicos de sci-fi



O que foi previsto na sci-fi?

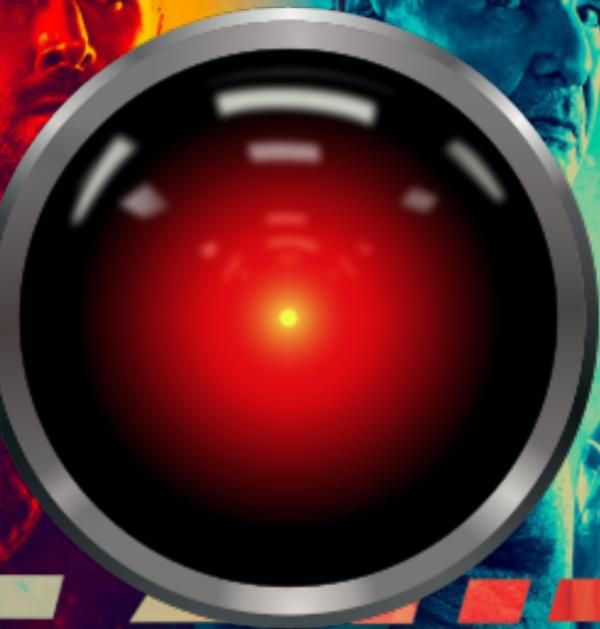
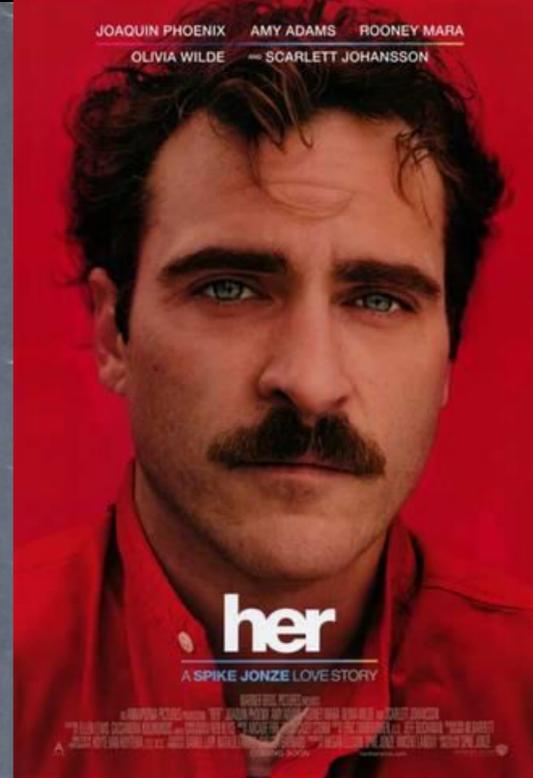
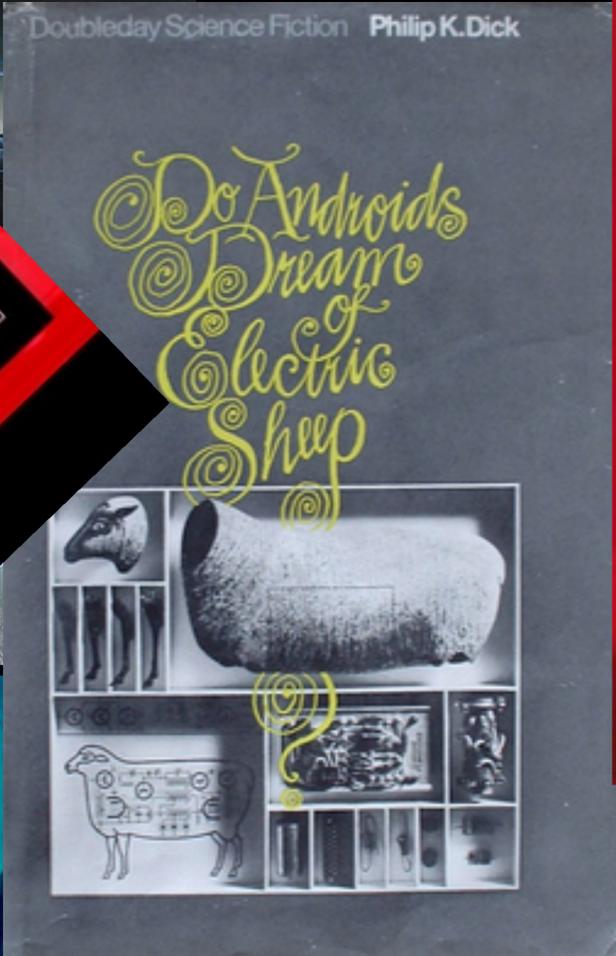
Fato vs Ficção

Inteligência artificial

HALO
ANNIVERSARY

HALO 3

HALO



OWN THE DIGITAL MOVIE & BLU-RAY™ NOW

BLADE RUNNER
A MICHAEL DEXLEY-HIDLEY SCOTT PRODUCTION
HARRISON FORD
BLADE RUNNER
EDWARD JAMES OLMON
RUTGER HAUER
SEAN YOUNG
BRIAN KELLY
HAMPTON FANCHER
DANIEL FELD
DOUGLAS THURMULL
VANGELIS
IVOR POWELL
MICHAEL DEXLEY
RIDLEY SCOTT

Primeira referência?

Samuel Butler (inglês), 1906, Erewhon

A consciência mecânica eventualmente vai surgir, apesar das máquinas possuírem pouca consciência agora. [...] Reflitamos sobre os extraordinários avanços que as máquinas têm feito nos últimos cem anos, e notemos o quão devagar os reinos animal e vegetal estão avançando. [...]

O que foi previsto?

1920: R.U.R., Karel Čapek (escritor tcheco)

Raça de robôs auto-replicantes revolta-se contra os donos humanos



Exterminador do Futuro. 1984

O que foi previsto?

1920: R.U.R., Karel Čapek (escritor tcheco)

Raça de robôs auto-replicantes revolta-se contra os donos humanos



Exterminador do Futuro. 1984

O que foi previsto?

1920: R.U.R., Karel Čapek (escritor tcheco)

Raça de robôs auto-replicantes revolta-se contra os donos humanos



#

1

"The Termini

Exterminador do Futuro 2. 1992

watchmoto

O que foi previsto?

1920: R.U.R., Karel Čapek (escritor tcheco)

Raça de robôs auto-replicantes revolta-se contra os donos humanos



#

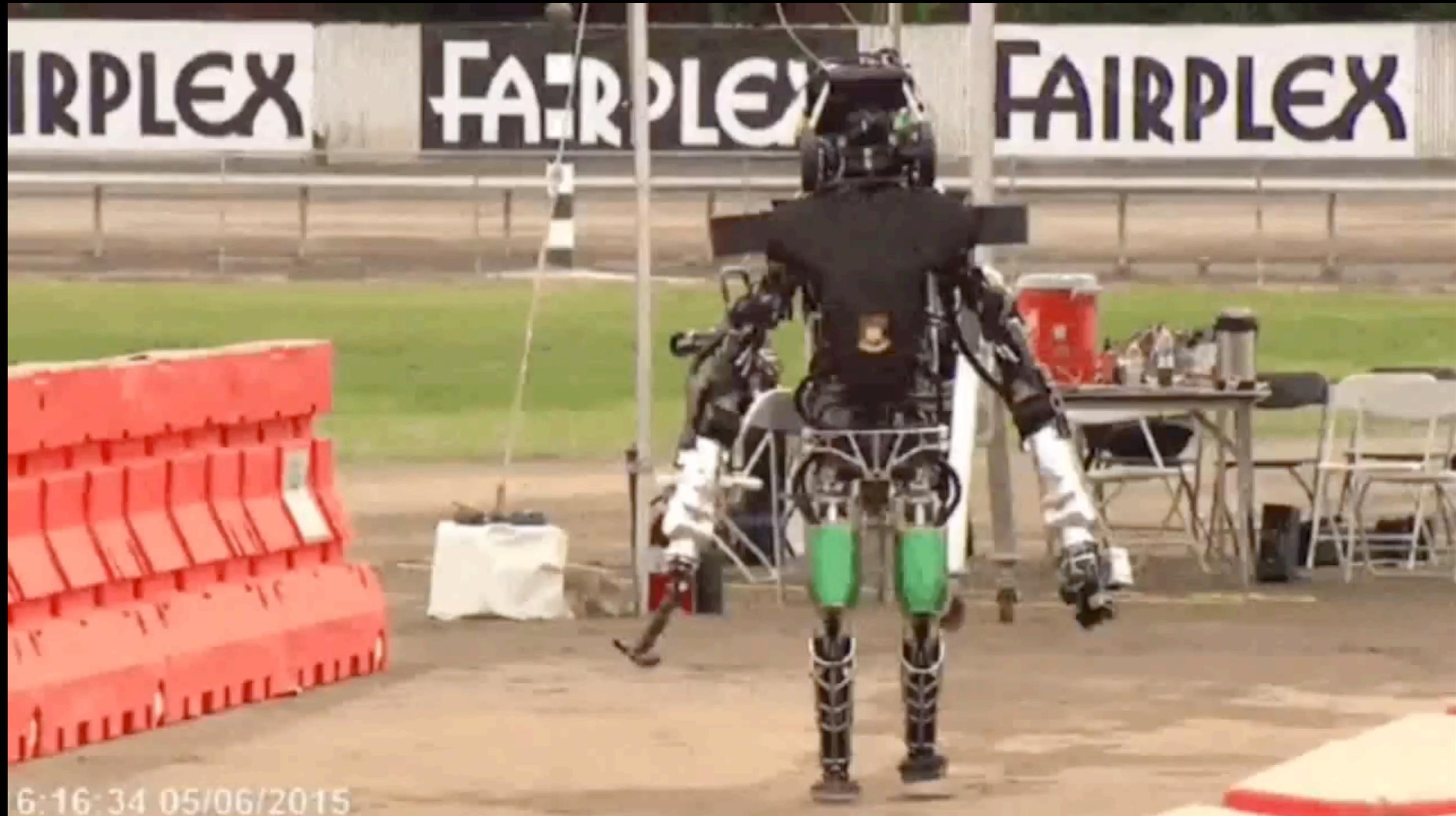
1

"The Termini

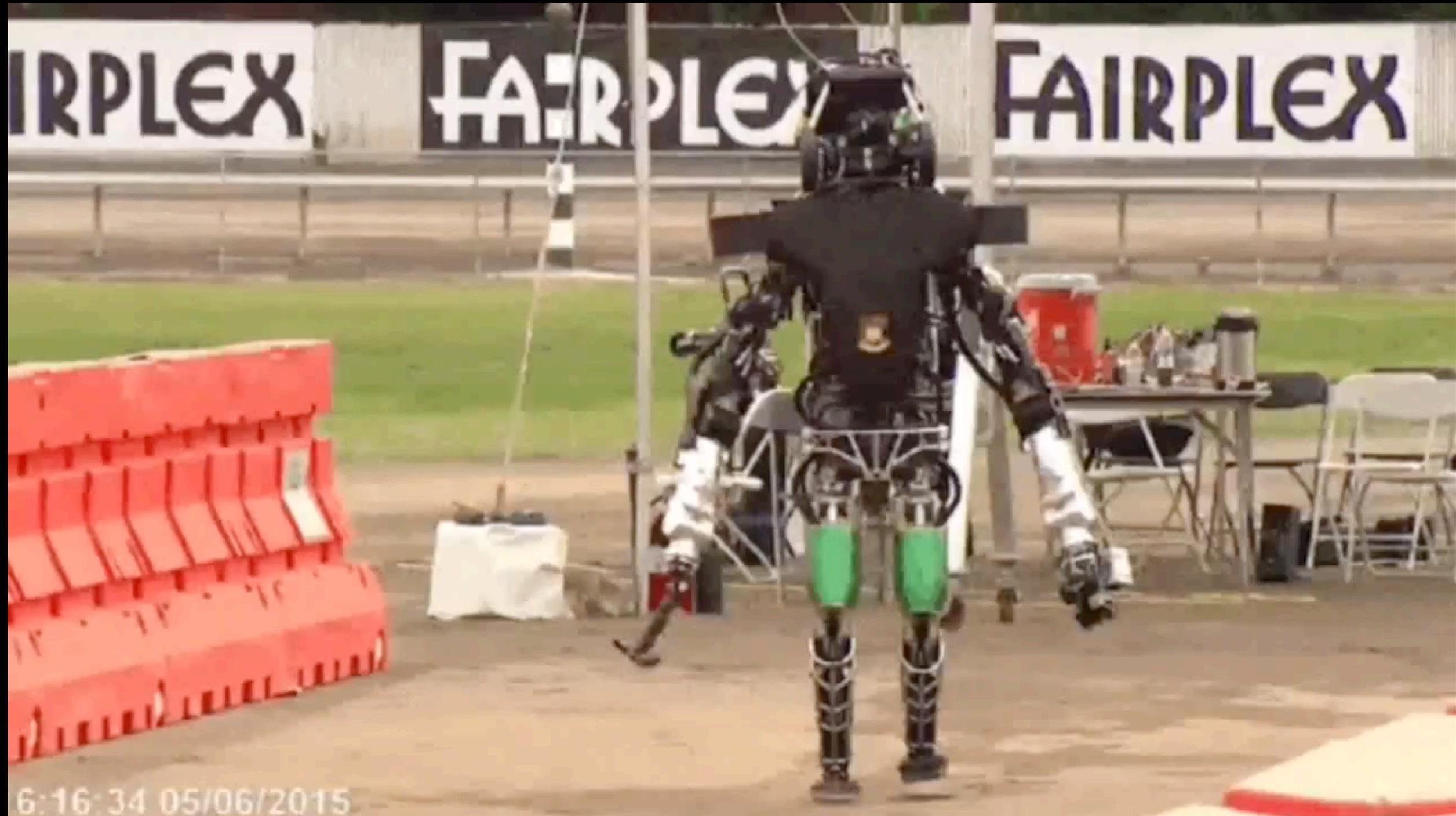
Exterminador do Futuro 2. 1992

watchmoto

O que já existe?



O que já existe?

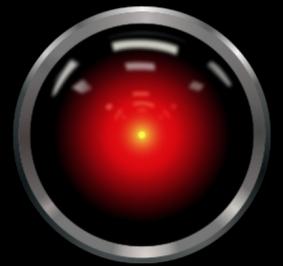


O que foi previsto?

Superinteligência antes de 2100



**Geralmente futuros distópicos
IA torna-se maléfica**



Robôs seriam a maior preocupação



O que já existe?

Algoritmos realizam tarefas específicas que normalmente necessitariam um humano

Carros automatizados

Reconhecimento de imagens, linguagem, fala

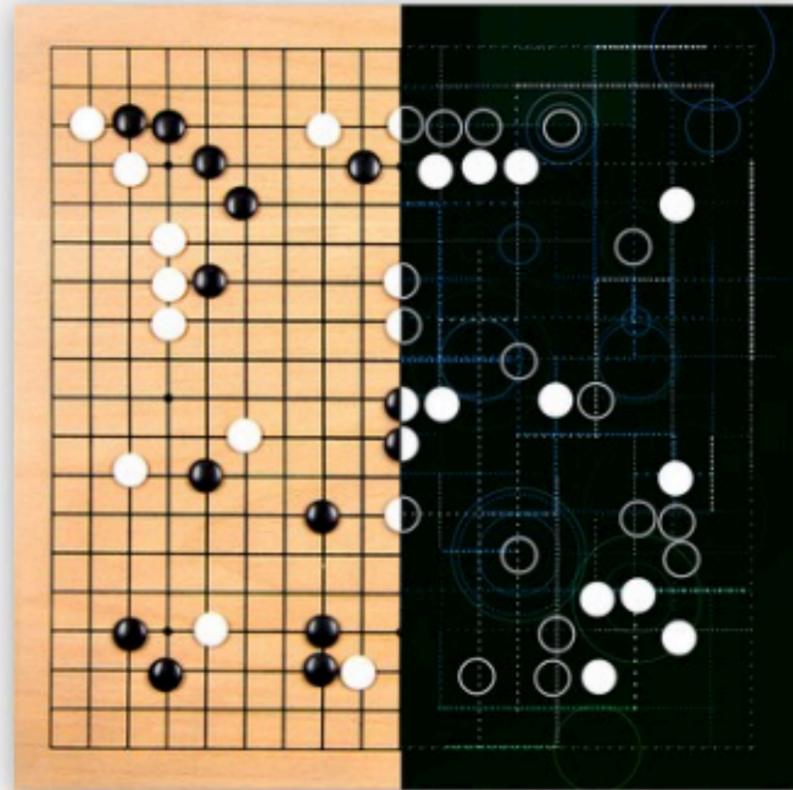
Tomada de decisões

Tradução instantânea

Jogos (xadrez, Go, NES)

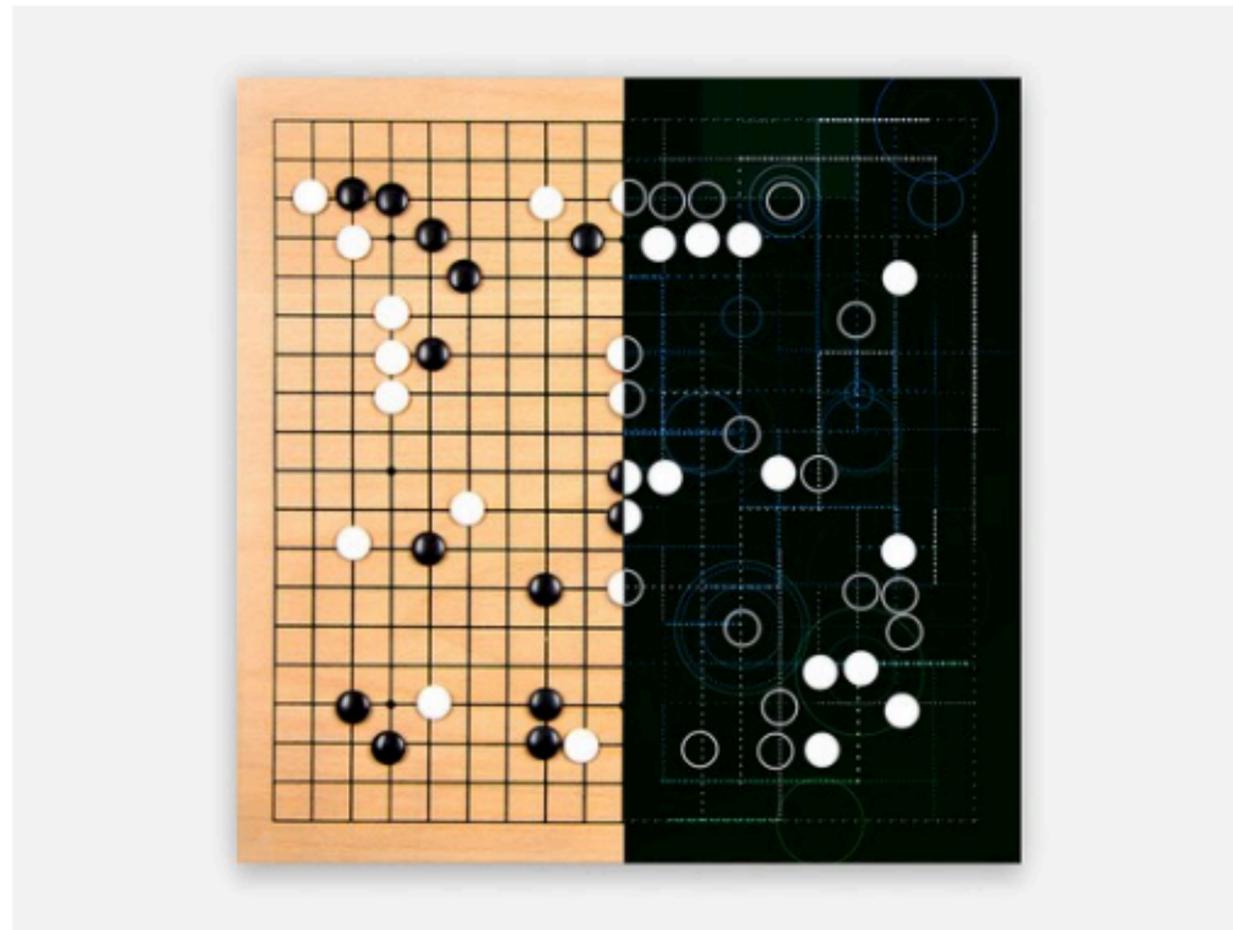
Inteligência artificial desenvolvida pelo Google derrota o melhor jogador de GO

WIRED



Inteligência artificial desenvolvida pelo Google derrota o melhor jogador de GO

WIRED



GOOGLE



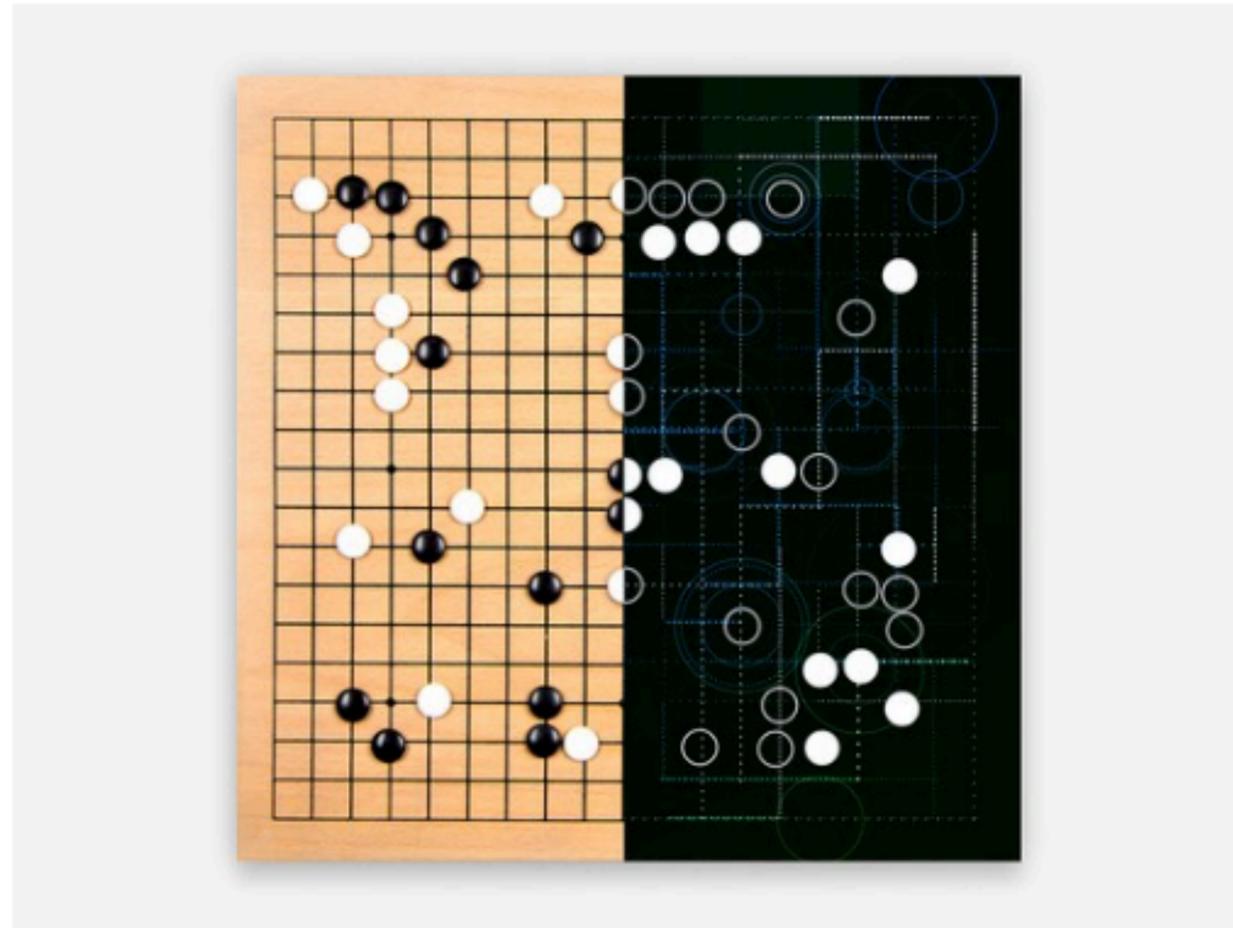
Inteligência artificial desenvolvida pelo Google derrota o melhor jogador de GO

WIRED



AlphaGo Zero: Algoritmo aprendeu jogando contra si mesmo

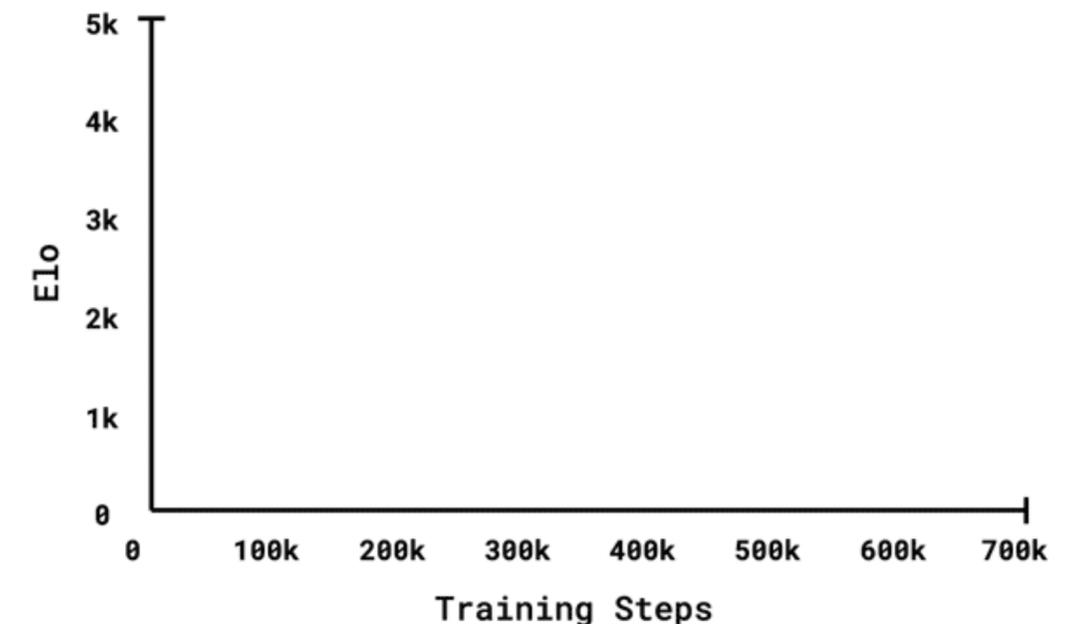
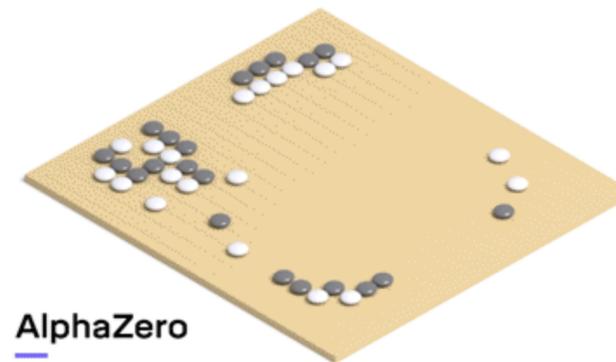
- Em 24 horas aprendeu sozinho e superou o melhor jogador do mundo
- Em 3 dias tornou-se imbatível contra uma versão anterior do algoritmo (AlphaGo Lee)
- Em 21 dias tornou-se imbatível contra todos os outros códigos existentes (AlphaGo Master)



GOOGLE



AlphaZero







Futurologia: Para discutir

Mudança disruptiva na economia: empregos com habilidades mais básicas se tornarão obsoletos

Como as futuras gerações devem se preparar?

Quais os riscos reais da AI a longo prazo?

O quão distantes estamos de uma IA genérica?

Exploração espacial

A STANLEY KUBRICK PRODUCTION

THE STARS ARE BETTER OFF WITHOUT US

THE EXPANSE
2.1 Syfy

The Ultimate Trip.

2001

A SPACE ODYSSEY

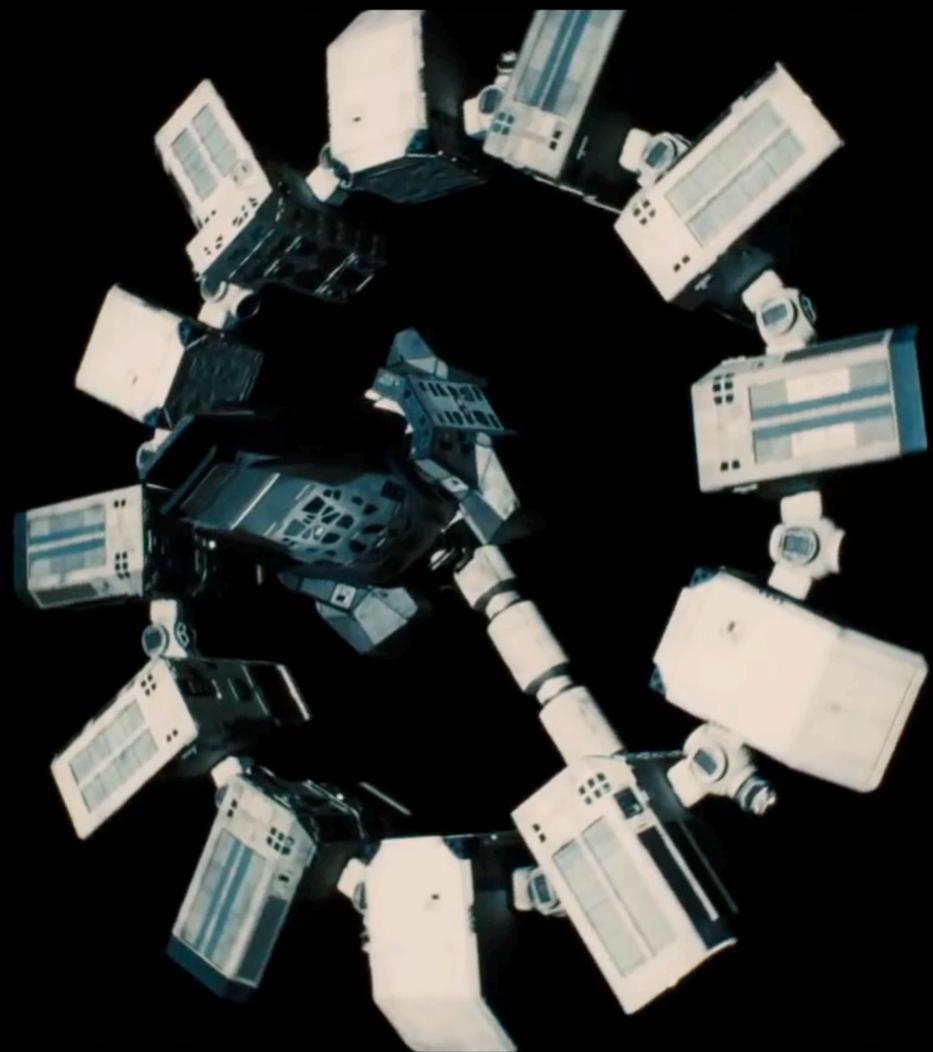
BRING
HIM
HOME

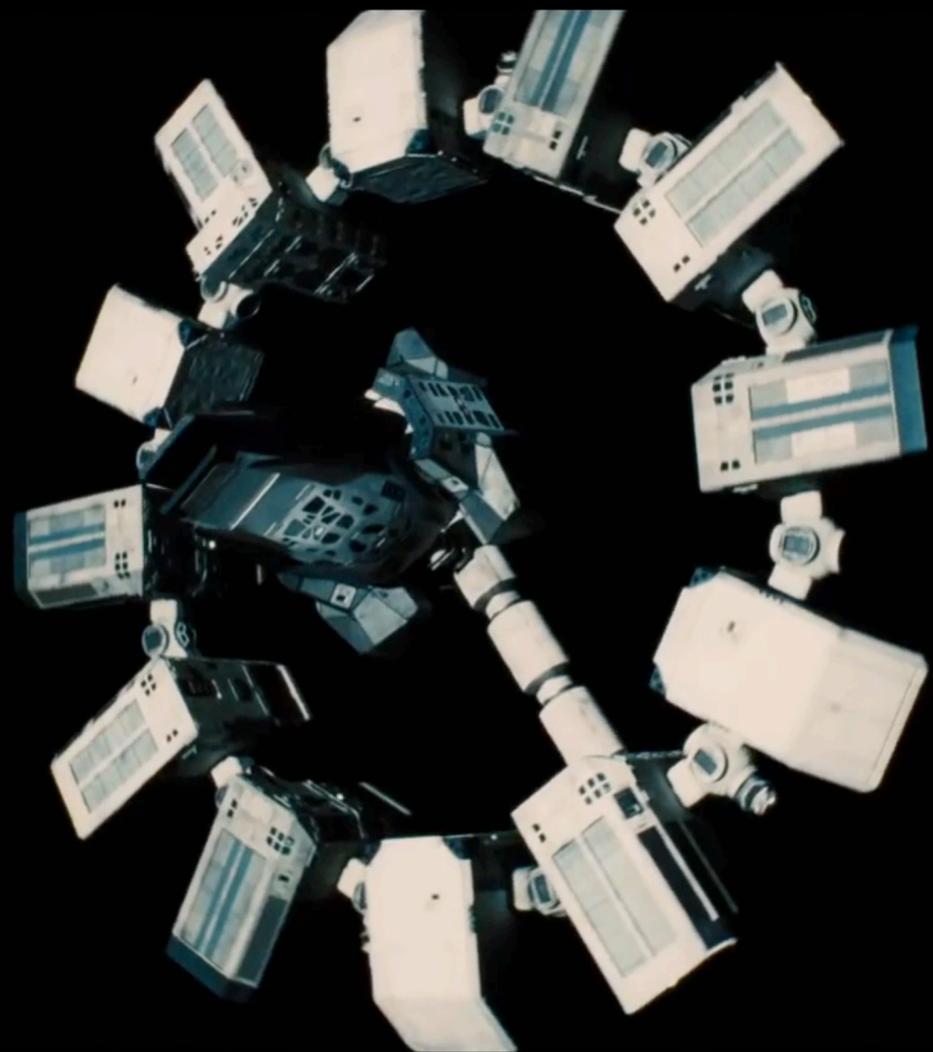
MATT DAMON
THE MARTIAN

ASIMOV
THE FIRST BOOK IN THE EPIC
FOUNDATION SAGA
FOUNDATION

Starring KEIR DULLEE, GARY LOCKWOOD





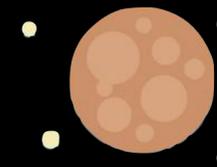


O que foi previsto?



**Humanidade em outros planetas
entre 2000-2050**

Colonização da Lua e Marte



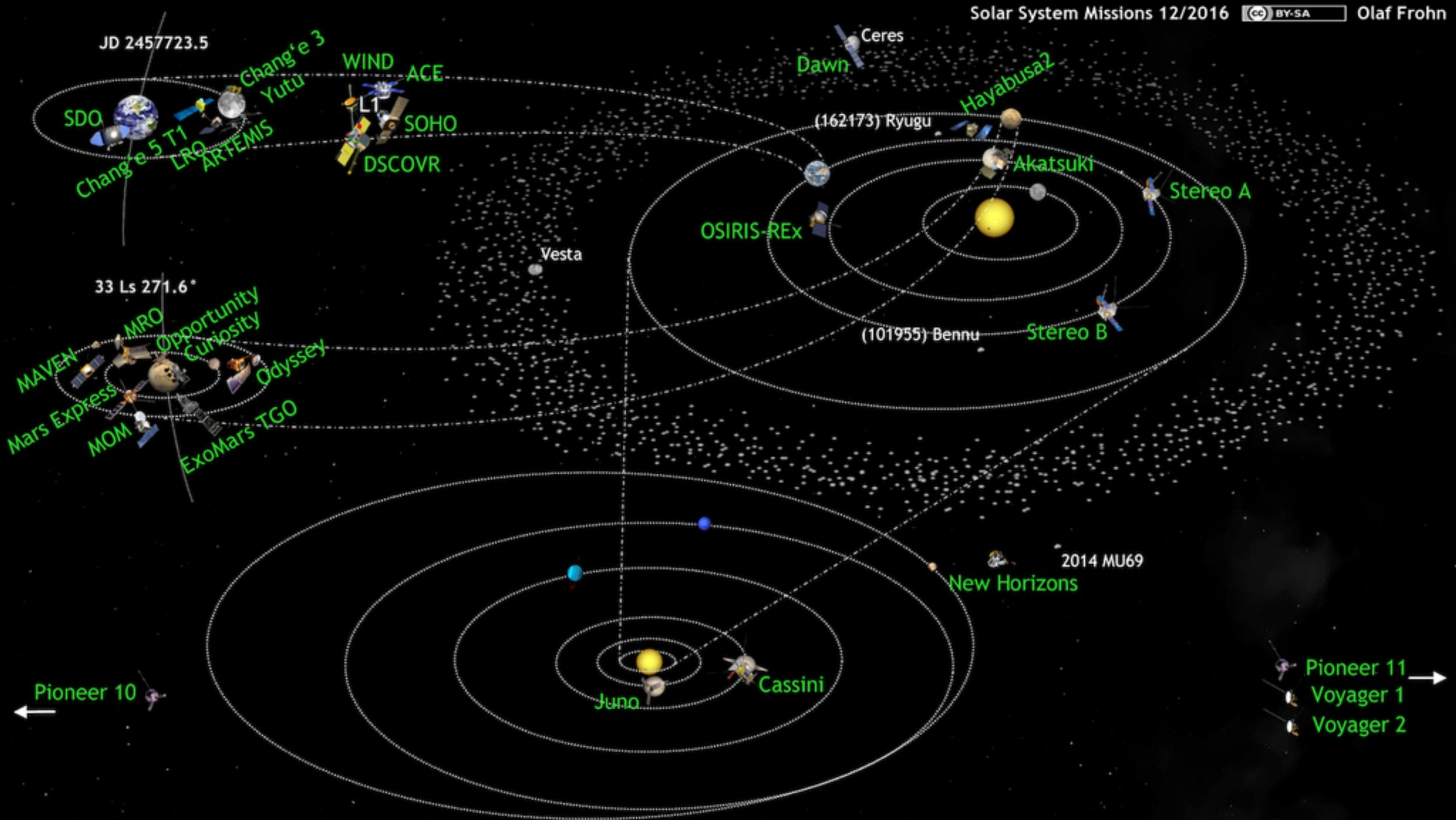
O que aconteceu?

Dezenas de sondas lançadas para outros planetas e asteróides

Uma sonda já deixou o Sistema Solar (140 UA, Voyager 1)

Estação Espacial Internacional (capacidade de dez pessoas)

Privatização da exploração espacial: SpaceX, Blue Origin, Breakthrough Starshot



Upcoming Events
2016
 Dec: Juno Science Orbit Jupiter
2017
 Apr: Cassini Grand Finale Orbits
 Sep: Cassini EOM
 Sep: OSIRIS-REx FB Earth
 Chang'e 5 Launch/SL Moon
 Lightsail 2 Launch
 FB: Flyby; OI: Orbit Insertion; App: Approach; Dep: Departure; Imp: Impact
 EDL: Entry, Descent and Landing; SL: Soft Landing; EOM: End of Mission

2018
 Mar: Juno EOM
 Apr: Bepi-Colombo Launch to Merc.
 May: InSIGHT Launch to Mars
 May: MarCO Launch to Mars
 Sep: OSIRIS-REx App Bennu
 Nov: InSIGHT EDL Mars
 Chandrayaan 2 Launch/SL Moon
 Hayabusa2 App/SL Ryugu

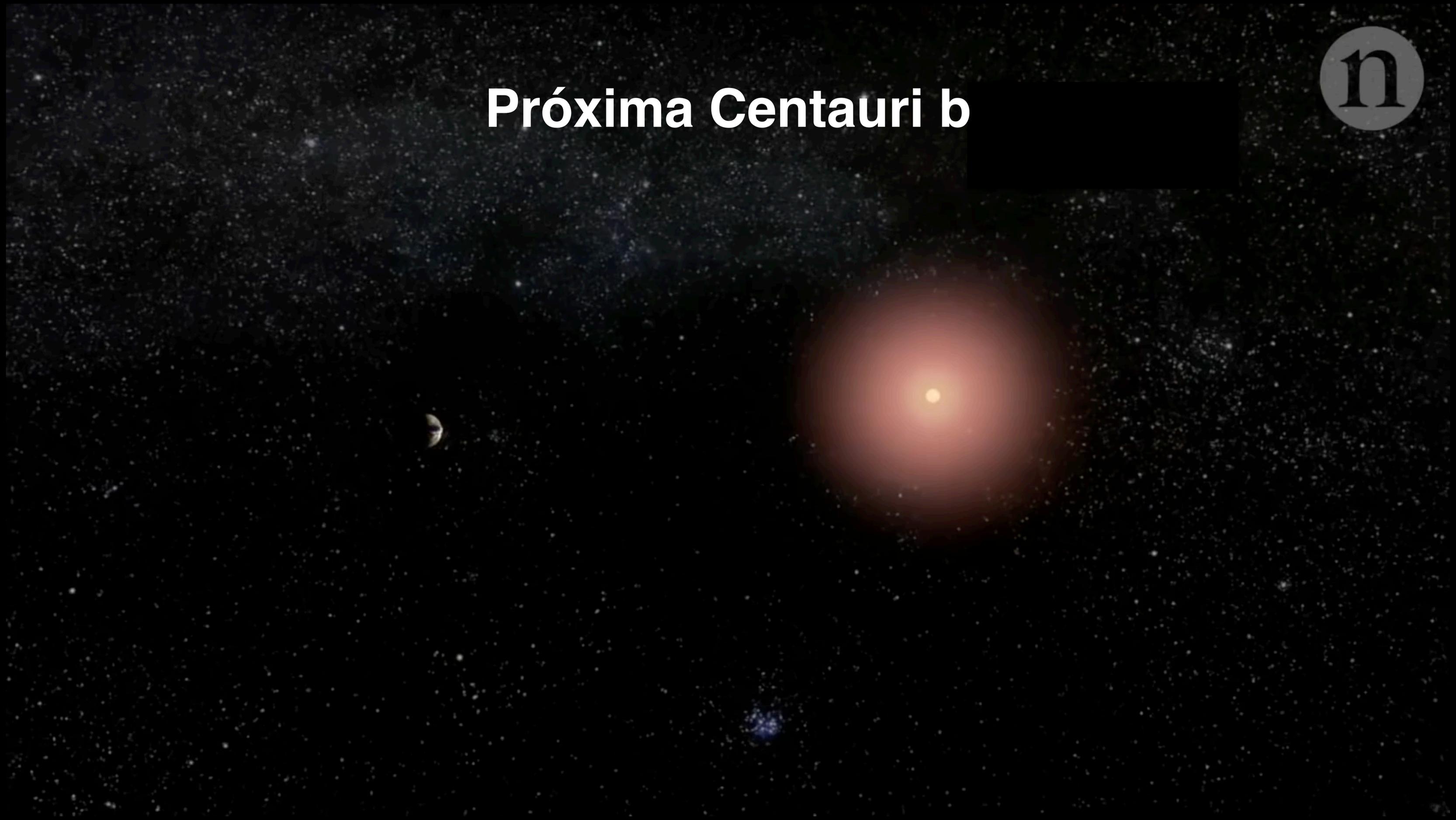
Chang'e 4 LRS Launch/OI Moon
 DSO Launch to Earth/Sun L1
 KPLO Launch/OI Moon
 Orion EM-1 Launch/FB Moon
 +10 EM-1 Cubesats Launch/OI/FB
 Moon/Heliocentric Orbit
 Red Dragon Launch to Mars
 Solar Probe Plus Launch
 Solar Orbiter Launch
2019
 Oct: OSIRIS-REx Sample Acq. Bennu

New Horizons FB 2014 MU69
 Hayabusa2 Sample acq. Ryugu
 Chang'e 4 Launch/SL Moon
 Luna 25 Lander Launch
2020
 2020 Mars Rover Launch
 Chang'e 6 Launch/SL Moon
 ExoMars Rover Launch
 Hayabusa 2 EDL Earth
 Mars Hope Launch to Mars
 MGRSO Launch to Mars

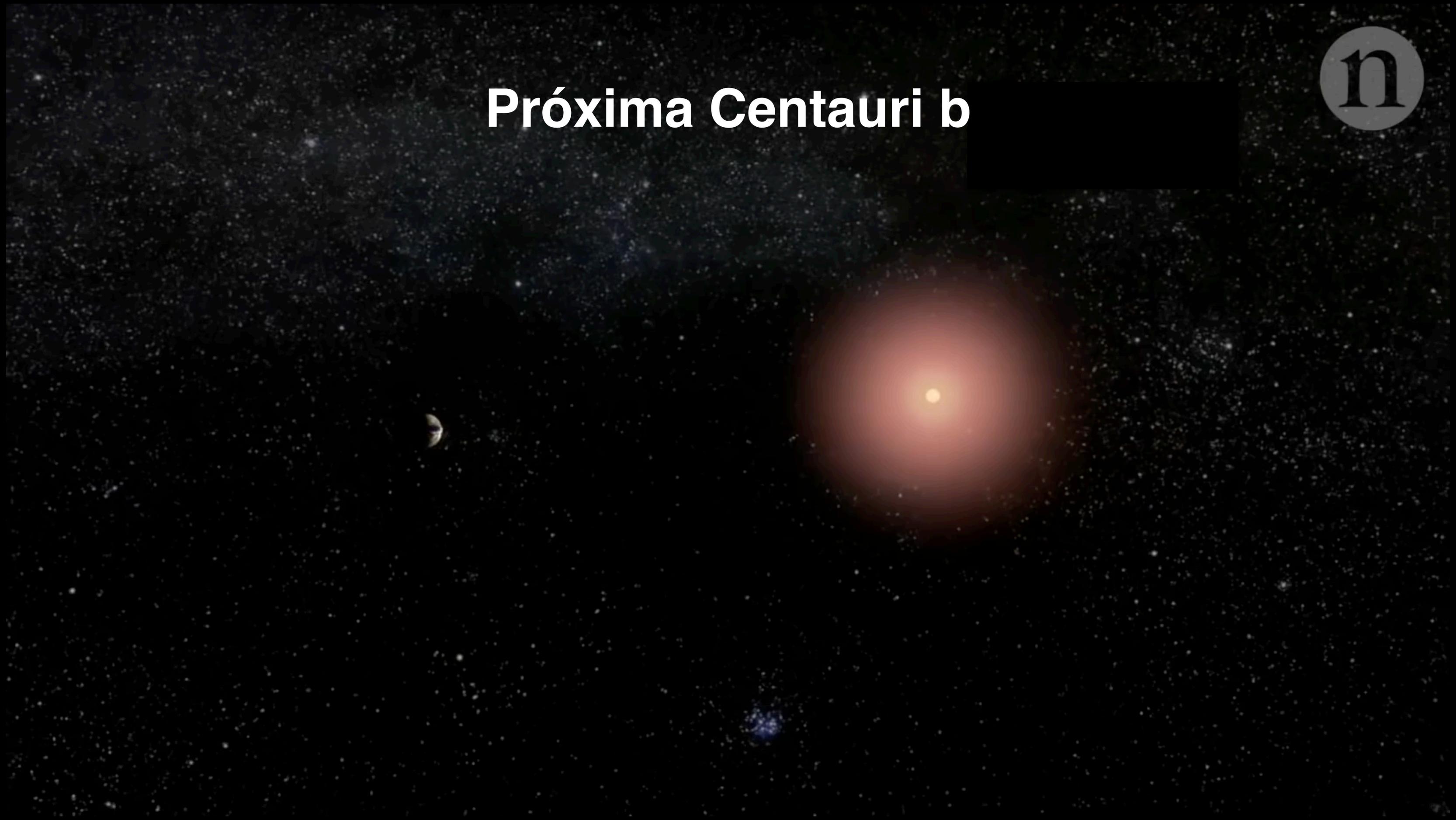
2021+
 Mar: OSIRIS-REx Dep Bennu
 ExoMars Rover EDL Mars
 Luna 26 Orbiter Launch
 Luna 27 Lander Launch (2023)
 [Chinese Asteroid FB] Launch (2022)
 EMFM Launch to Jupiter (2022?)
 EM-2 Launch to Cislunar Space (2023)
 JUICE Launch to Jupiter (2022)
 OSIRIS-REx EDL Earth (2023)
 Luna 27 Lander Launch (2023)
 Bepi-Colombo OI Mercury (2024)

**Sobre viagem
interestelar...**

Próxima Centauri b



Próxima Centauri b



Distância Terra — Próxima Centauri b
= 43.000.000.000.000 km

Distância Terra — Próxima Centauri b
= 43.000.000.000.000 km

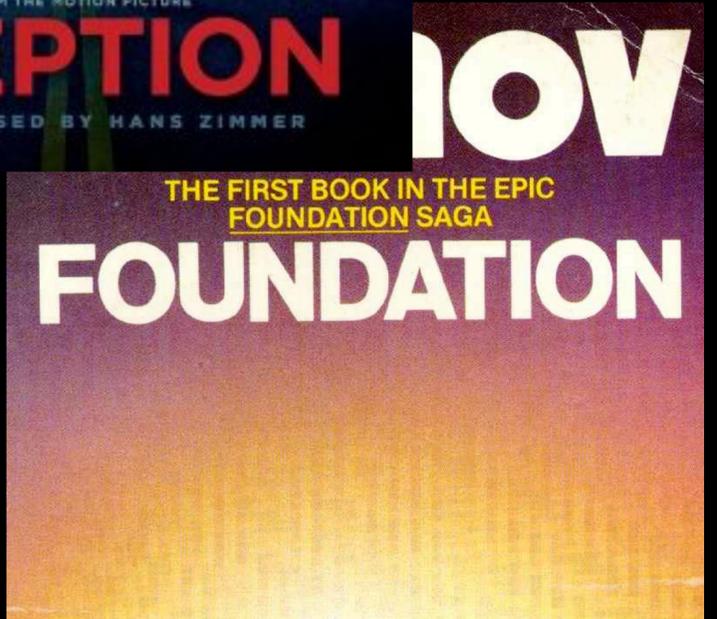
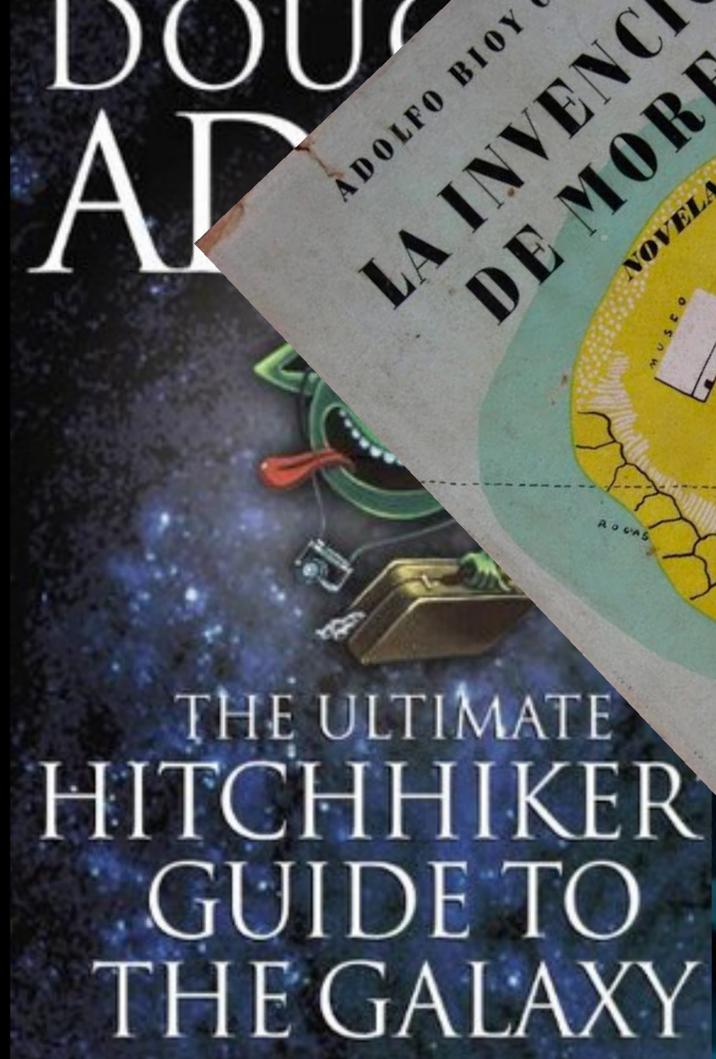
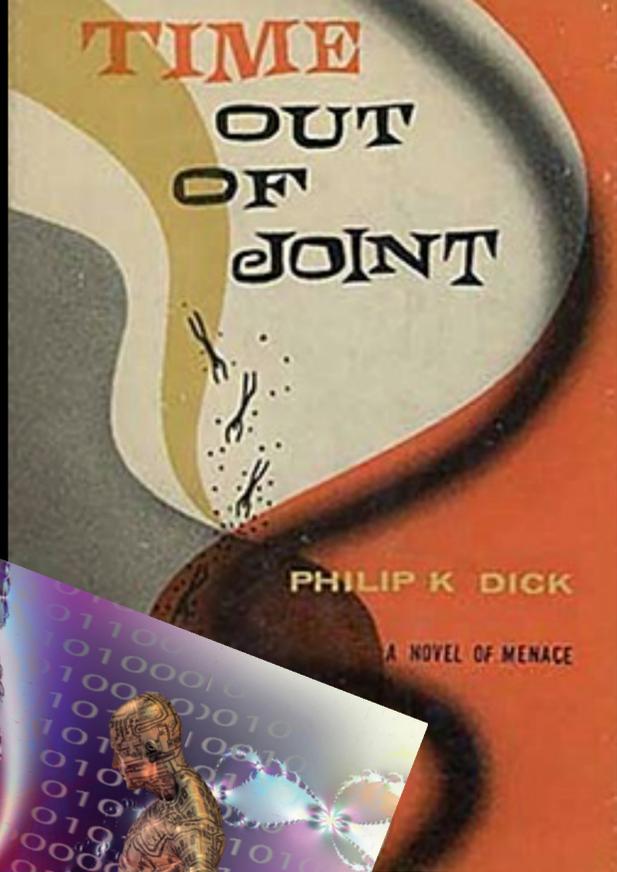
87 mil anos de viagem

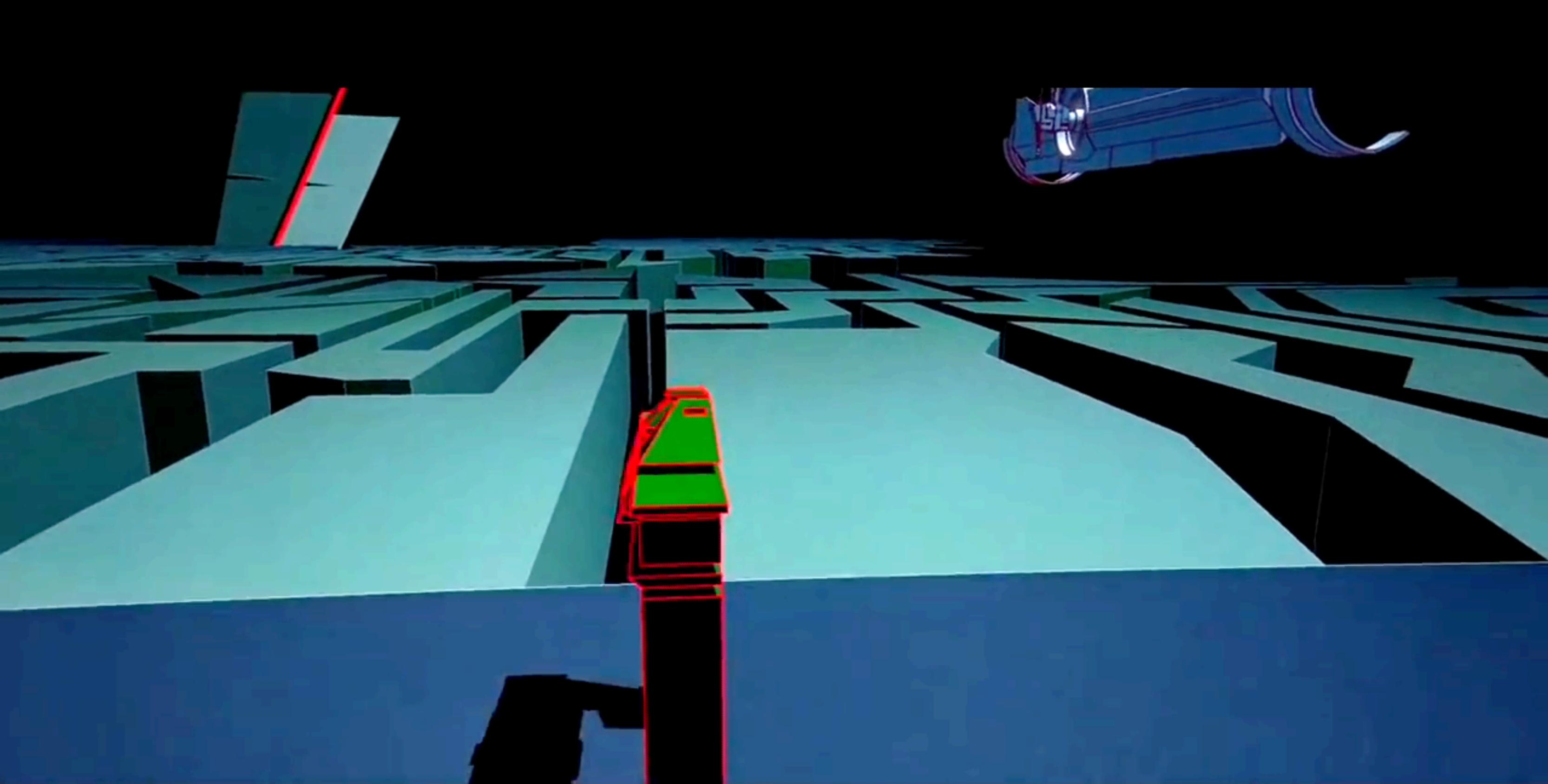
Futurologia: Para discutir

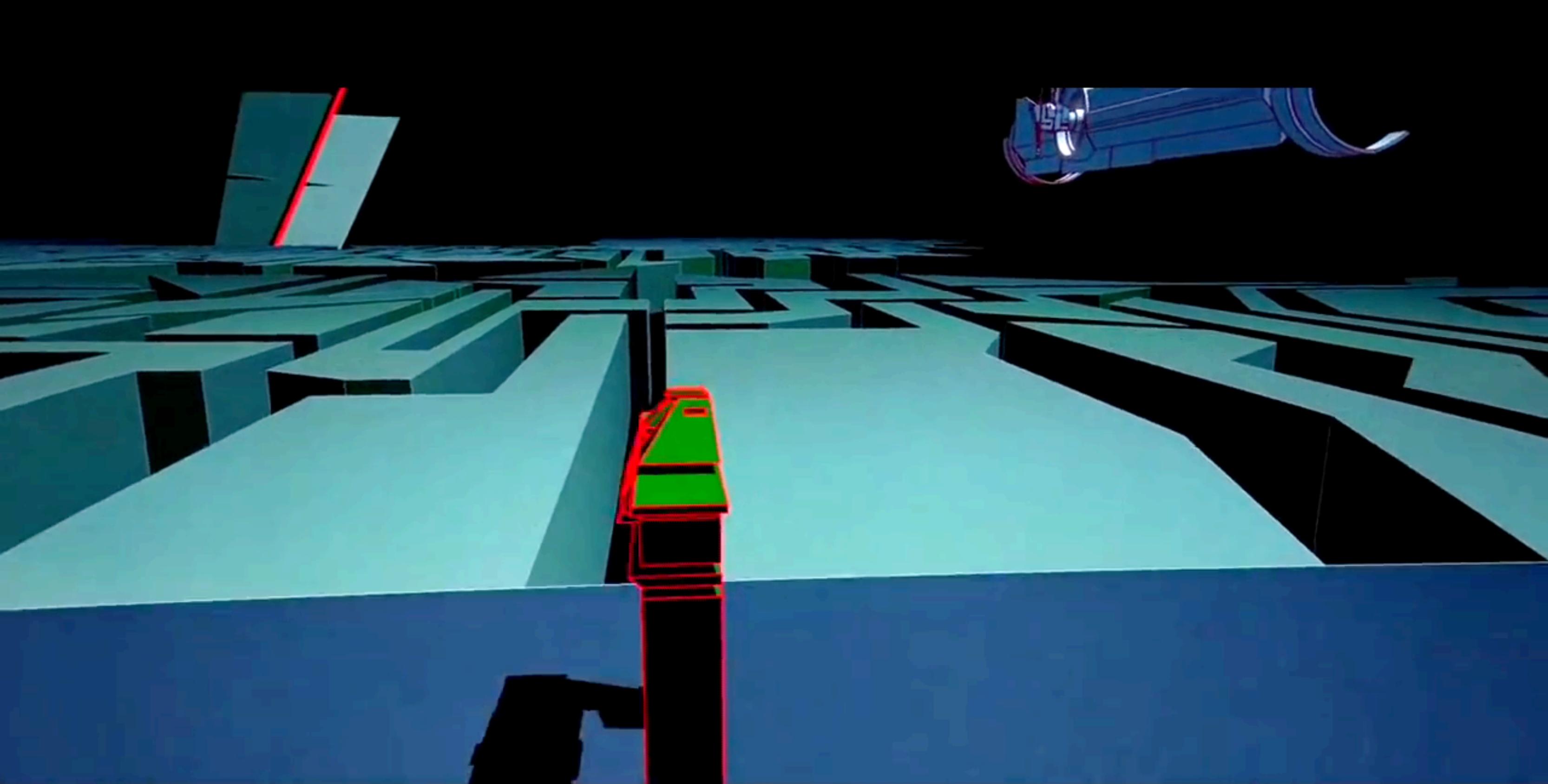
Quanto tempo até o primeiro humano chegar em Marte?

Qual o futuro da exploração espacial?

Simulações da realidade e realidade virtual







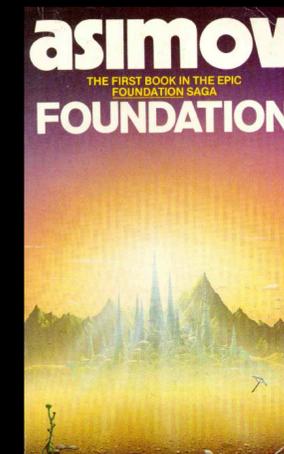
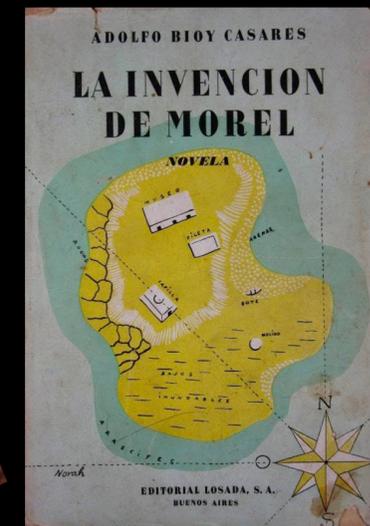
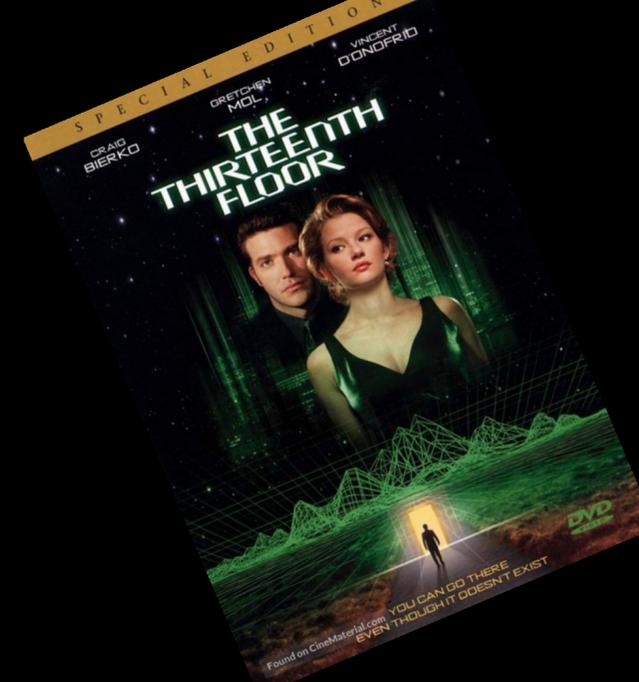
O que foi previsto?

Realidade física *recriada* em simulações computacionais.

Entidades (humanos plugados ou IAs) que muitas vezes não sabem que habitam uma simulação

Simular e prever com exatidão muitos fenômenos, inclusive o futuro da huma

Dispositivos de realidade virtual (VR) seriam muito populares nos anos 2000



O que aconteceu?

Sociedade depende de algoritmos e computação de alto desempenho (e.g. previsão do tempo, aquecimento global, ciência)



Avanços em renderização movidos pela indústria de cinema e games – efeitos *visuais* quase indistinguíveis da realidade

VR não atingiu mainstream, mas avançou muito (Oculus Rift, PS4 VR)

TV “3D” foi um grande fracasso



Simulação da evolução do universo *inteiro*

14 bilhões de anos em 2
meses de supercomputador



Time since the Big Bang: 8.0 billion years

<http://www.illustris-project.org>

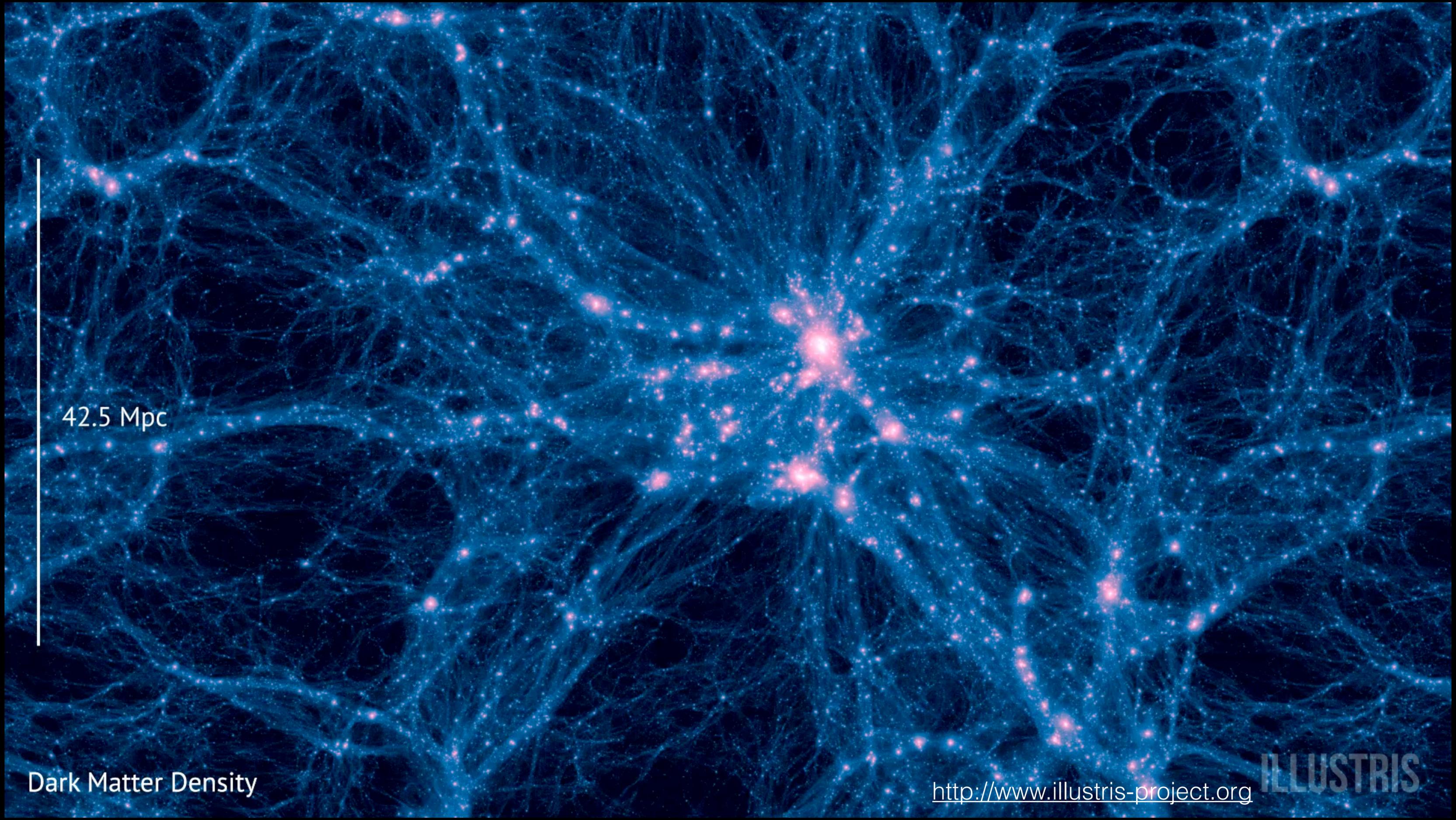
ILLUSTRIS



Time since the Big Bang: 8.0 billion years

<http://www.illustris-project.org>

ILLUSTRIS

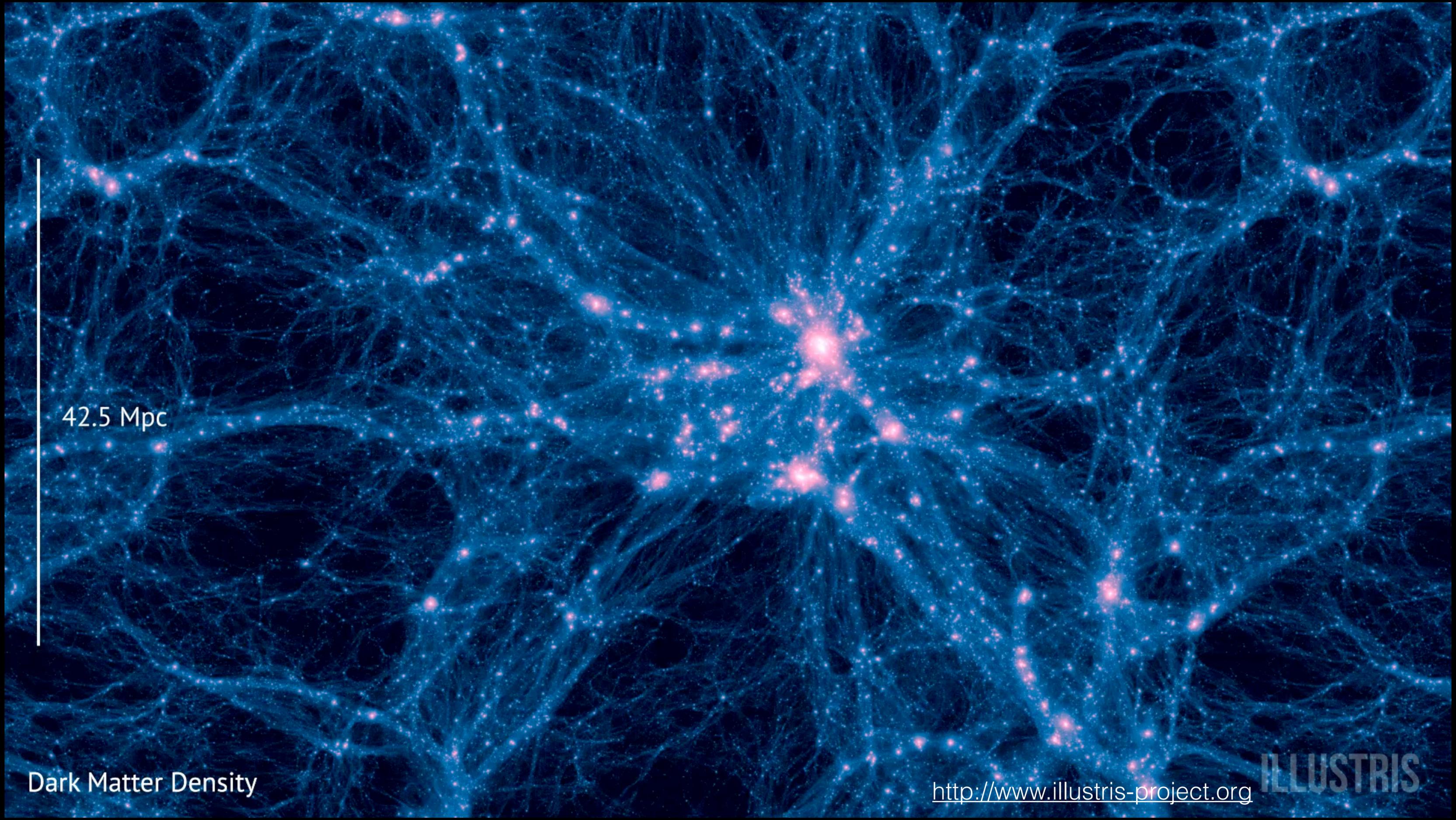


42.5 Mpc

Dark Matter Density

<http://www.illustris-project.org>

ILLUSTRIS



42.5 Mpc

Dark Matter Density

<http://www.illustris-project.org>

ILLUSTRIS

Futurologia: Para discutir

Qual o limite das simulações computacionais?

Será possível simular “vida” e consciência?

Avanço das simulações cosmológicas

Vivemos numa simulação? :)



E-mail

rodrigo.nemmen@iag.usp.br



Web

rodrigonemmen.com



Twitter

@nemmen



Github

rsnemmen



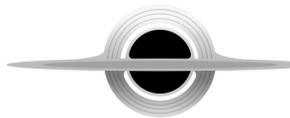
Facebook

facebook.com/rodrigonemmen



Bitbucket

nemmen



Group

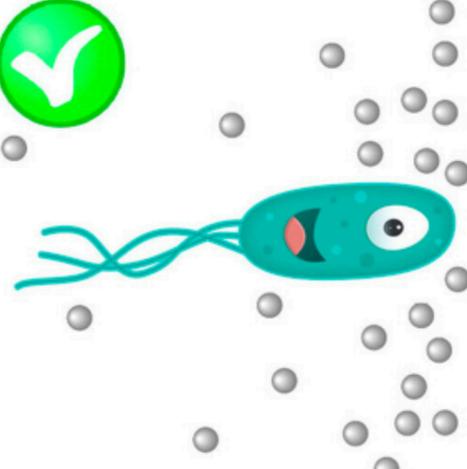
blackholegroup.org



figshare

bit.ly/2fax2cT

Director's cut

Can it design its hardware?			 
Can it design its software?		 	 
Can it survive & replicate?	 	 	 
	Life 1.0 (simple biological)	Life 2.0 (cultural)	Life 3.0 (technological)

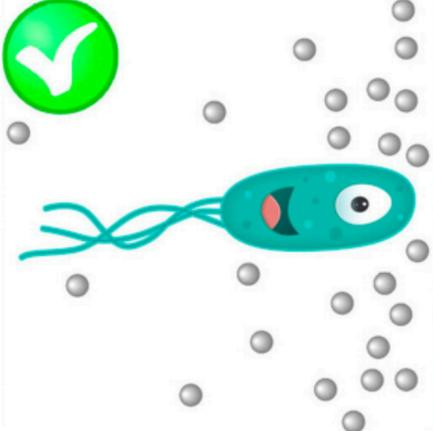
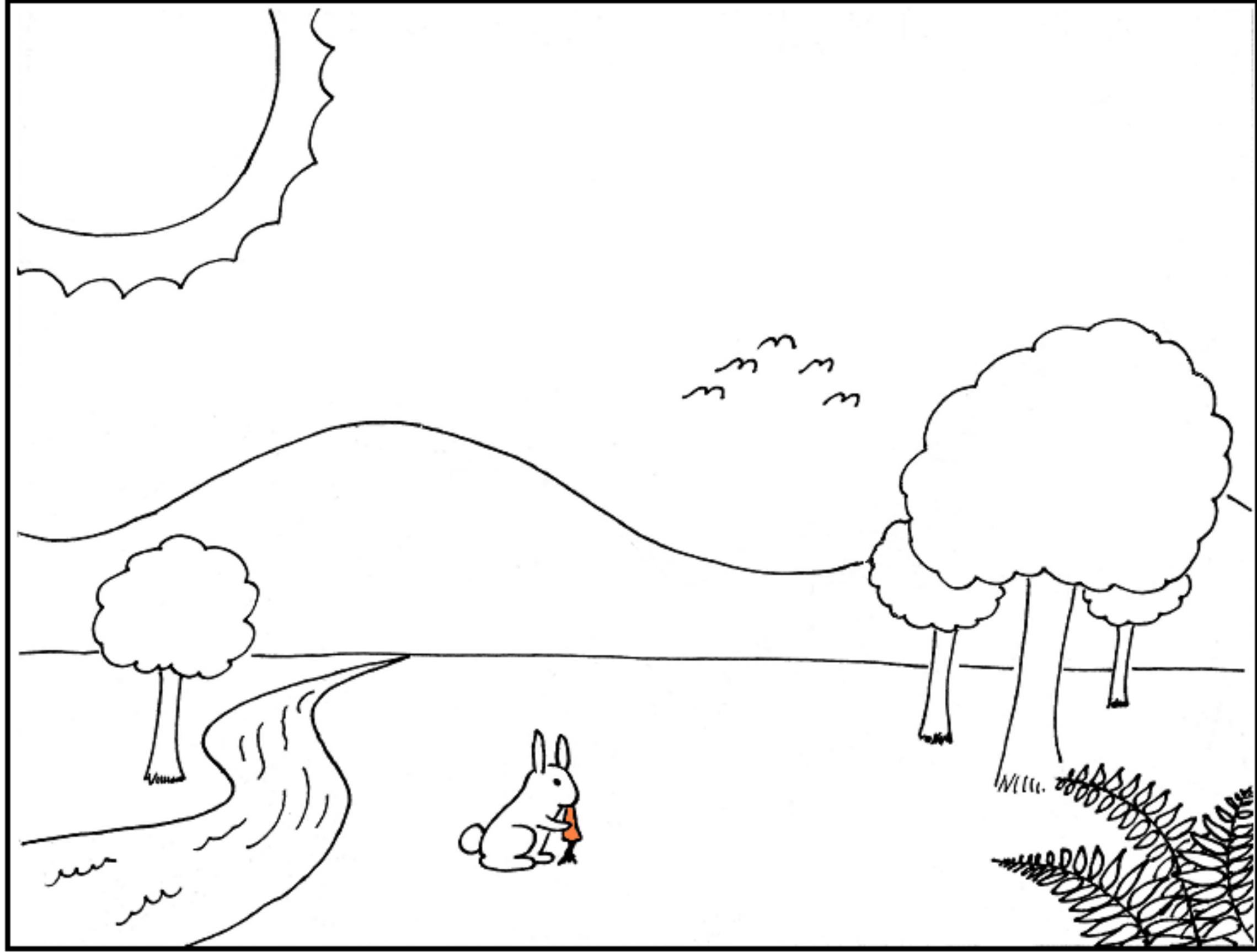
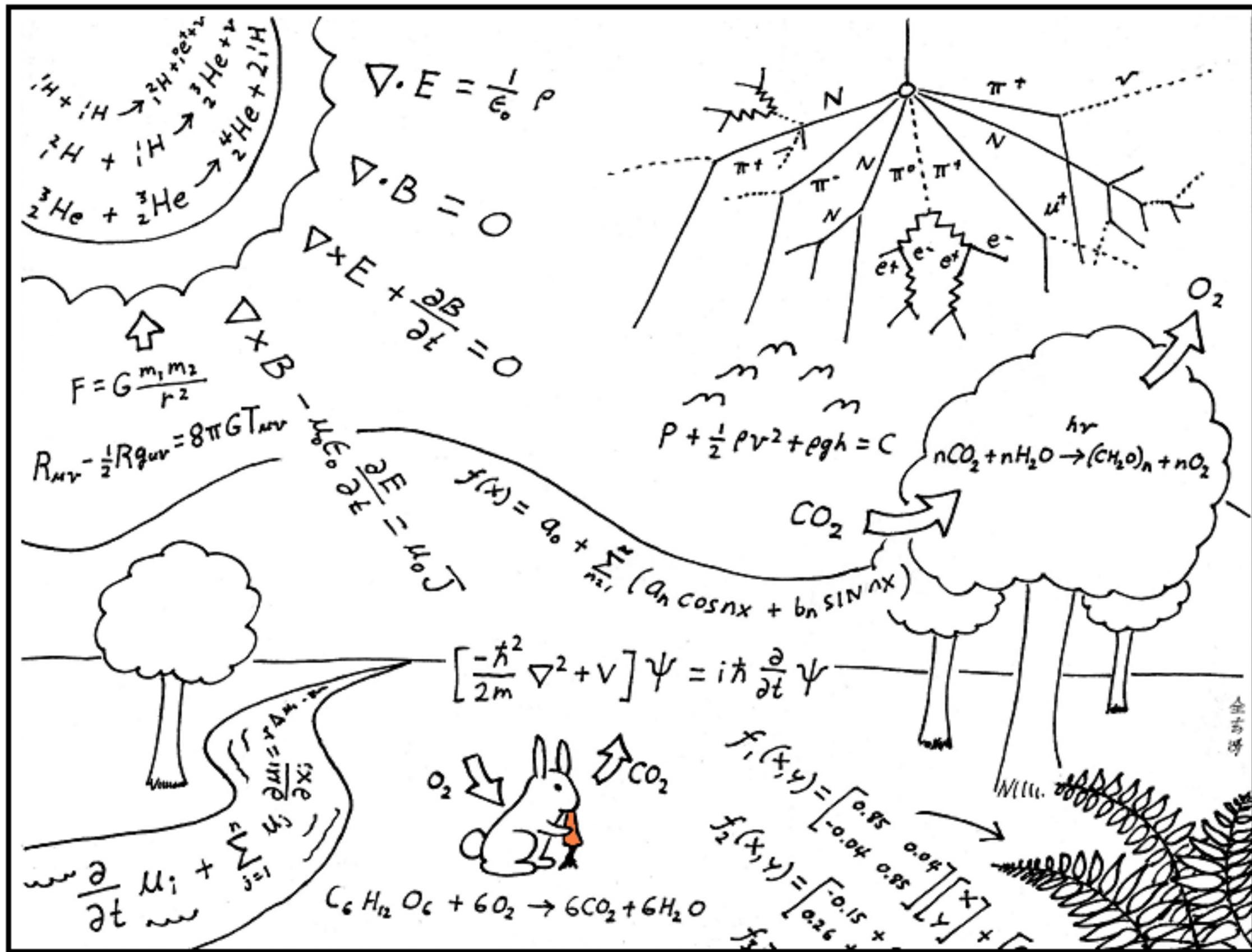
Can it survive & replicate?	 	 	 
	Life 1.0 (simple biological)	Life 2.0 (cultural)	Life 3.0 (technological)

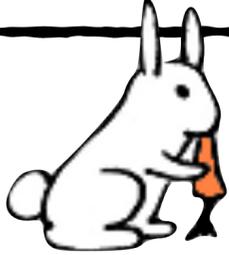
Figure 1.1: The three stages of life: biological evolution, cultural evolution and technological evolution. Life 1.0 is unable to redesign either its hardware or its software during its lifetime: both are determined by its DNA, and change only through evolution over many generations. In contrast, Life 2.0 can redesign much of its software: humans can learn complex new skills—for example, languages, sports and professions—and can fundamentally update their worldview and goals. Life 3.0, which doesn't yet exist on Earth, can dramatically redesign not only its software, but its hardware as well, rather than having to wait for it to gradually evolve over generations.

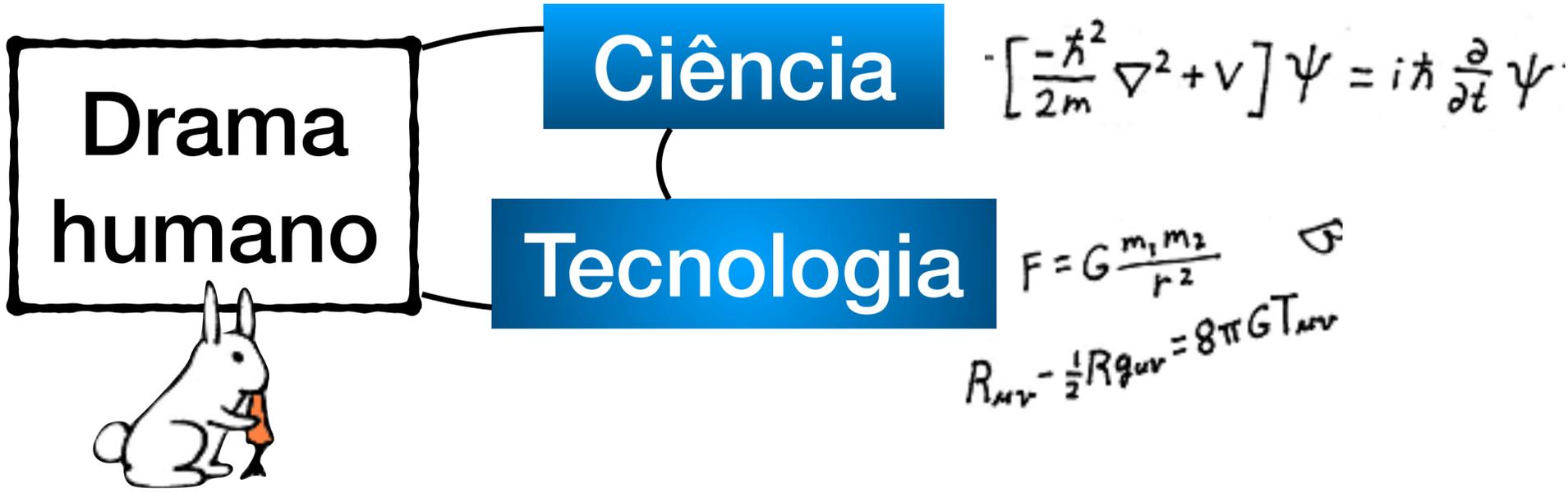


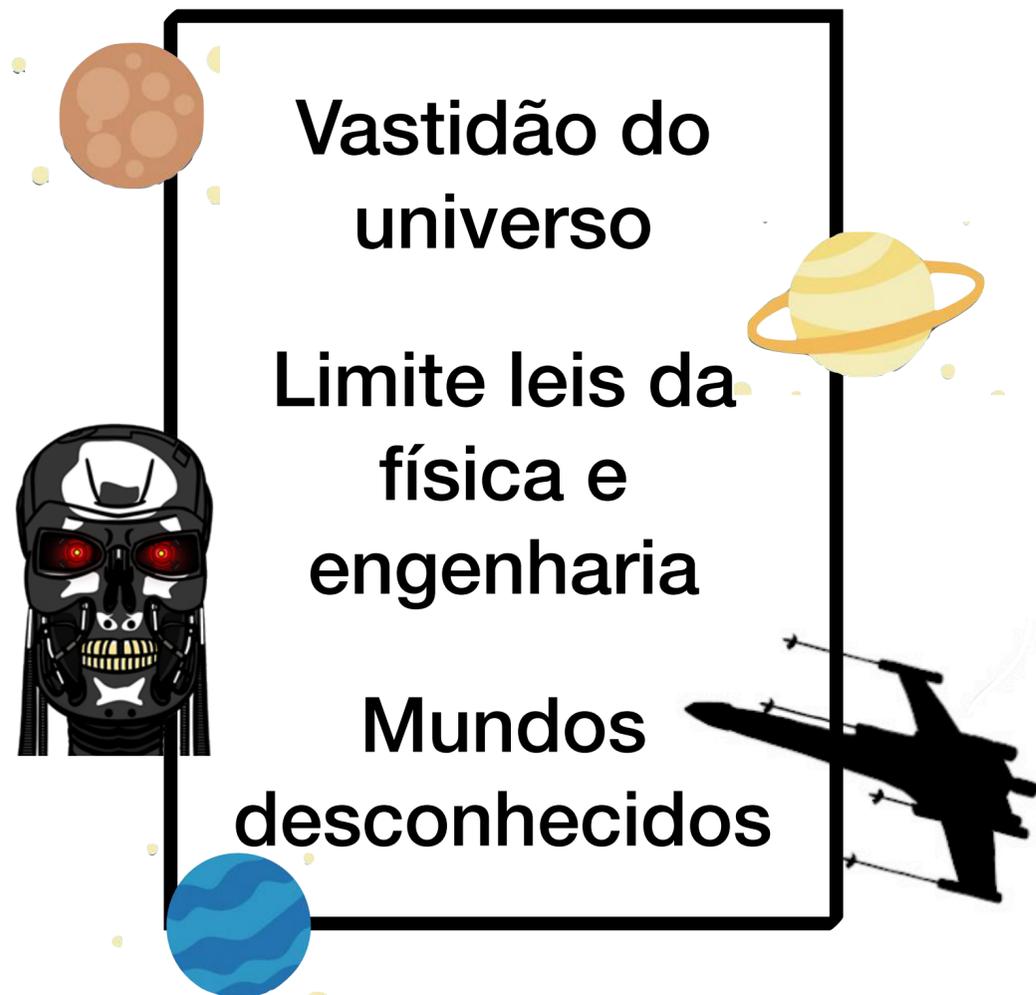
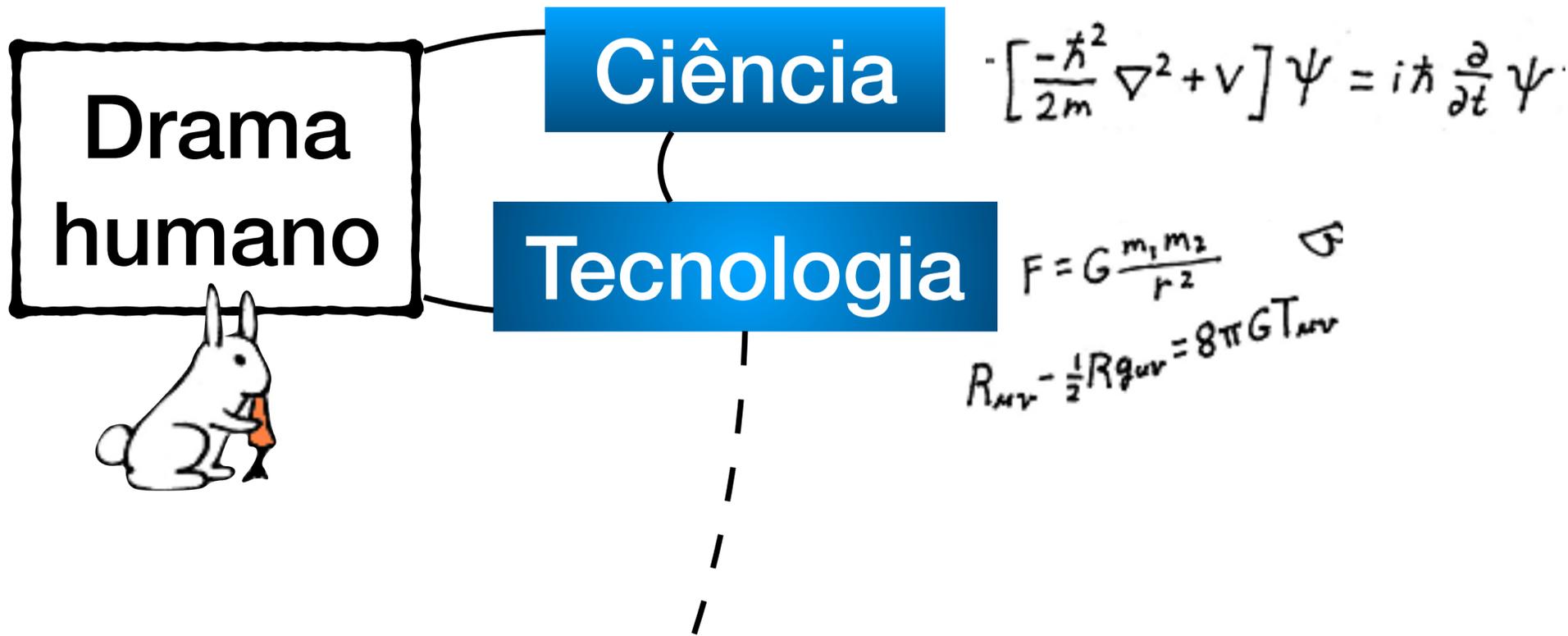


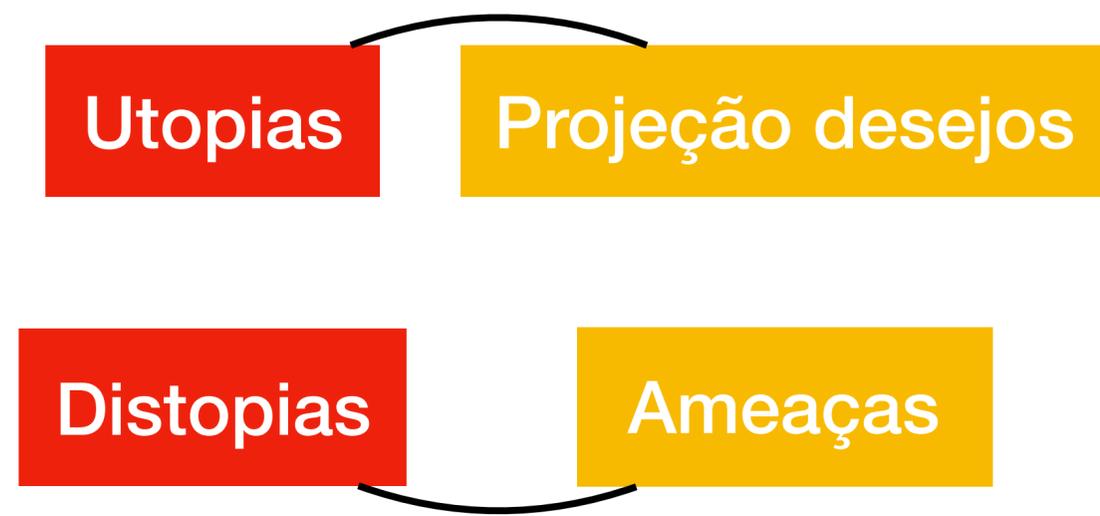
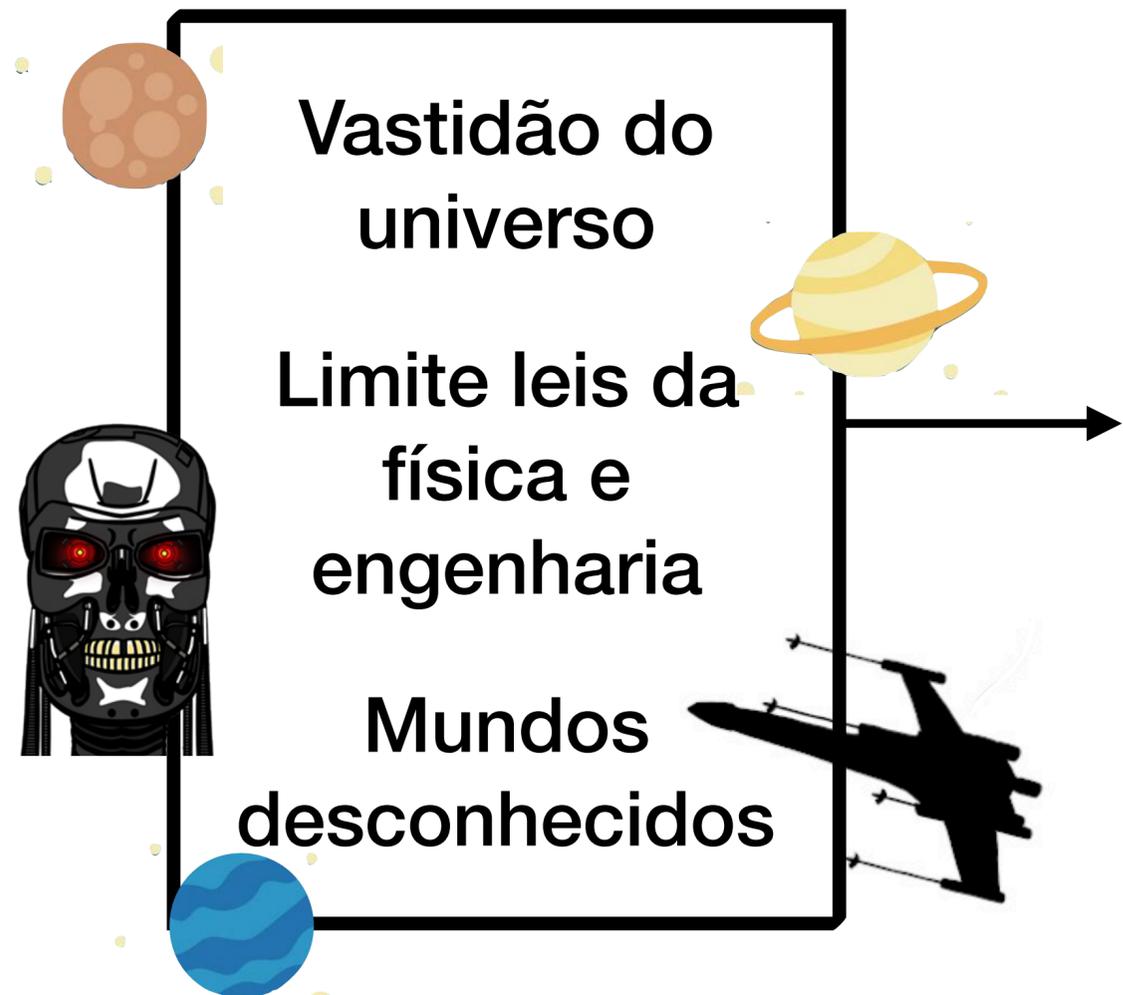
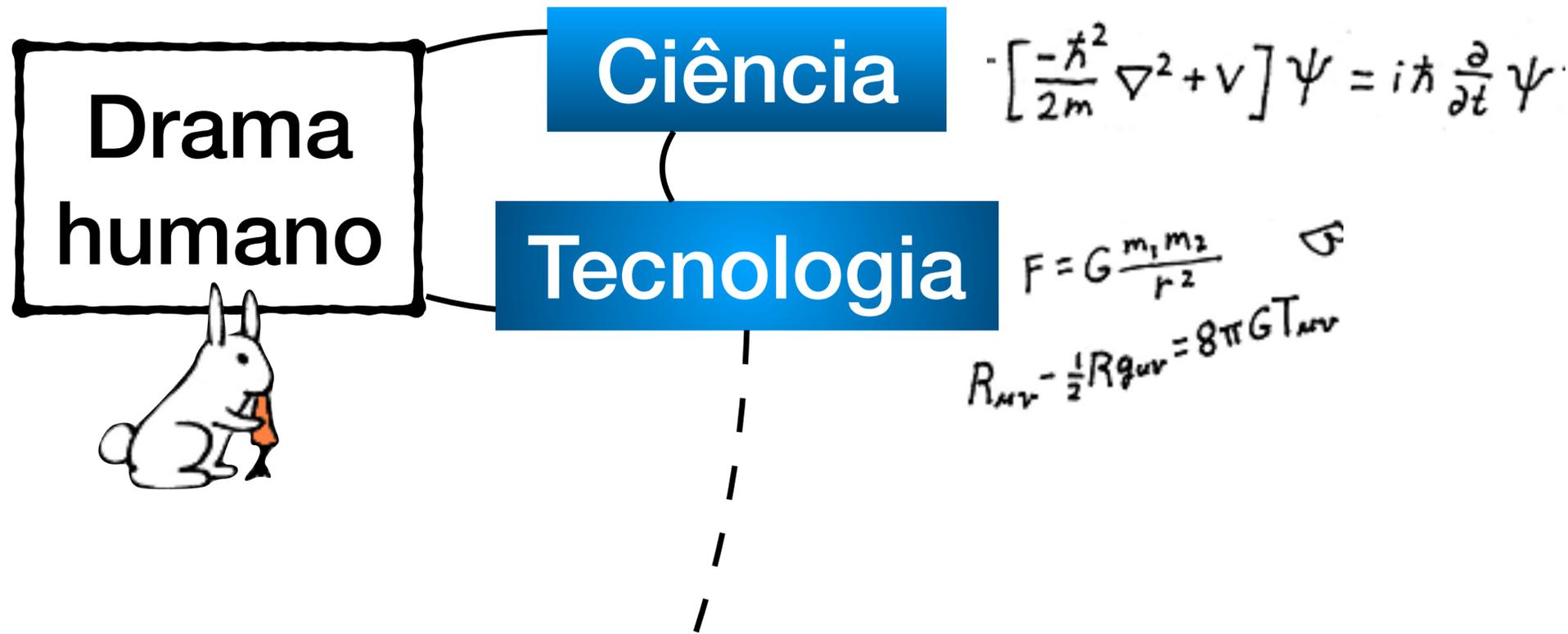
Os cientistas vêm o mundo assim

**Drama
humano**









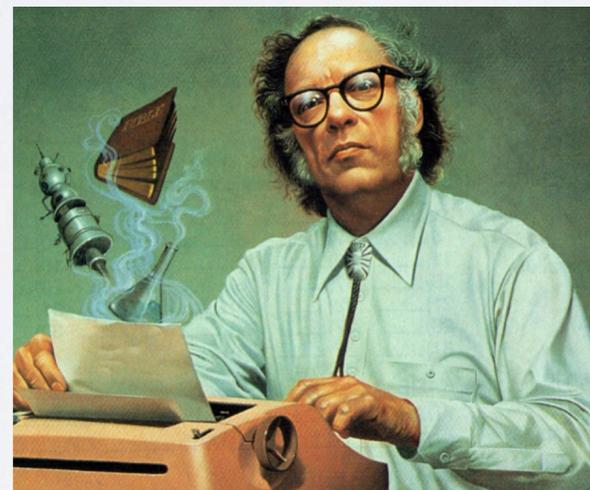
O que cientistas e criadores de ficção científica têm em comum?

Uma imensa curiosidade sobre as possibilidades do futuro

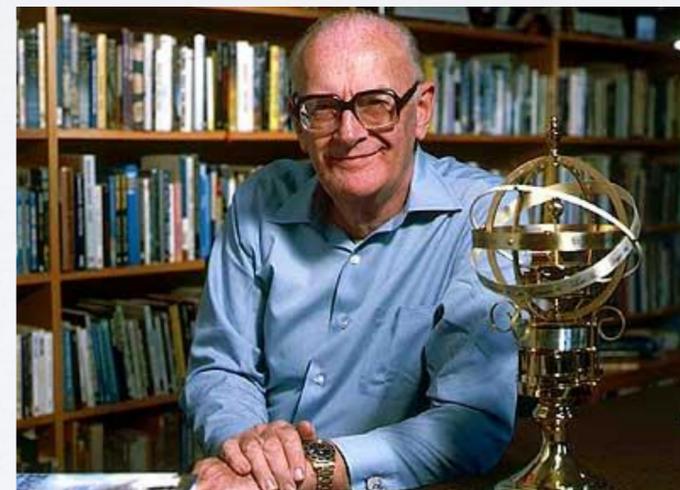
De fato, muitos desses autores eram (são!) cientistas!



HG Wells
Biólogo



Isaac Asimov
Prof. de Bioquímica, Univ. Boston



Arthur C Clarke
Matemático e Físico



Neil Stephenson
Físico e Geógrafo

Sagan
Brotherton

Importância da sci-fi na minha vida

- Primeiro livro que li foi sci-fi
- Filme Contato inspirou minha escolha de carreira



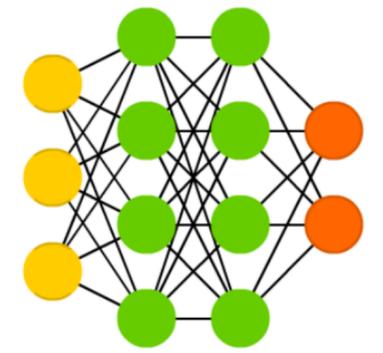
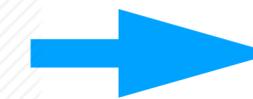
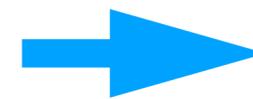
Inteligência artificial

O que já existe? IA

Algoritmos (programas de computador) que aprendem com dados existentes, inspirados no funcionamento do cérebro



Dados



Rede neural

TREINAMENTO

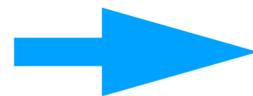
Entrada



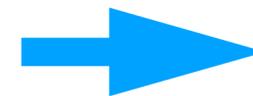
+ "rótulos"



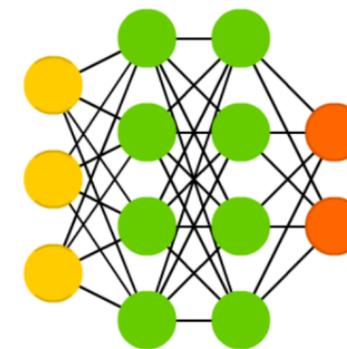
dados de treinamento



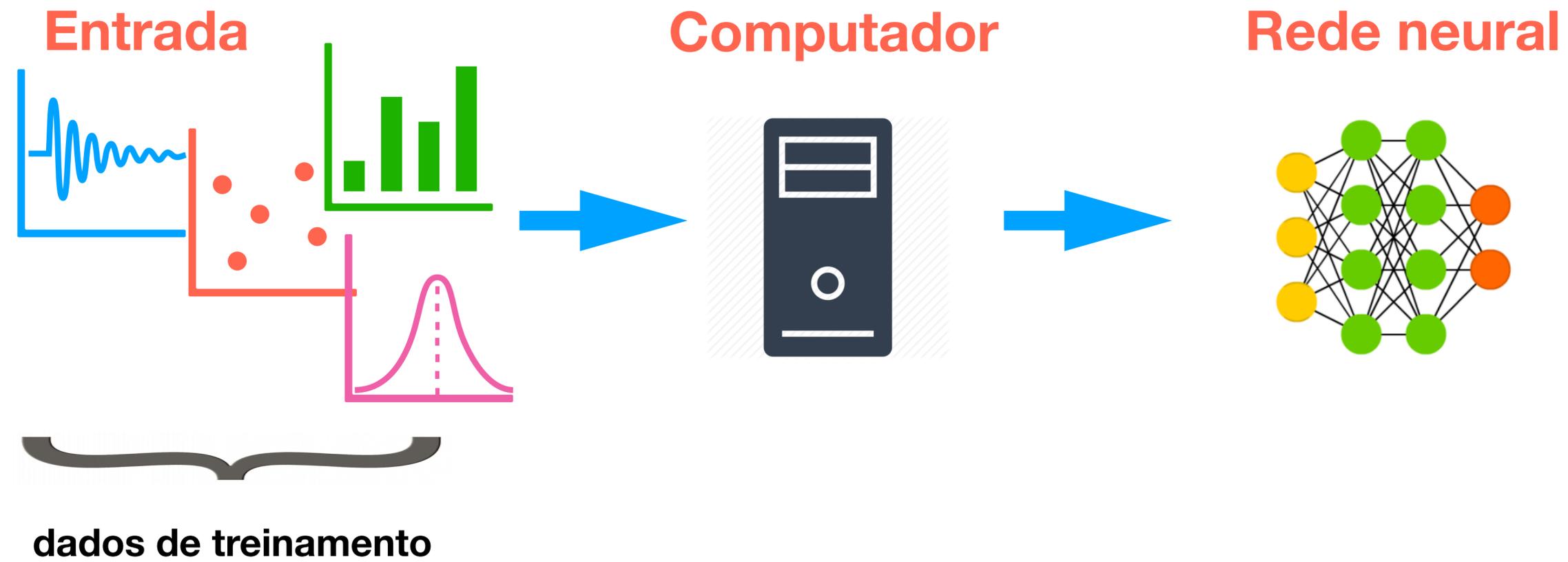
Computador



Rede neural

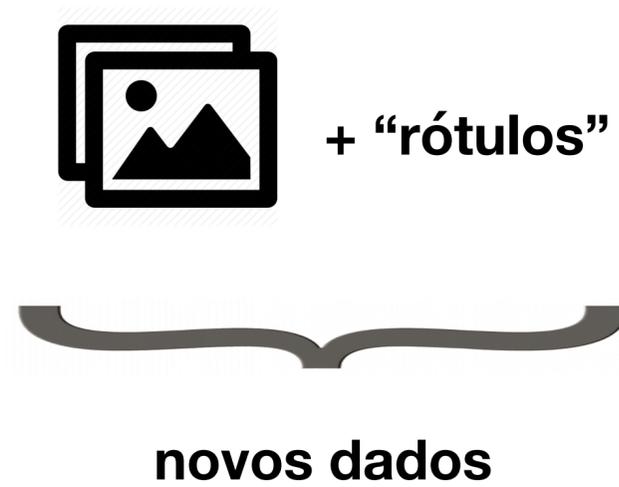


TREINAMENTO

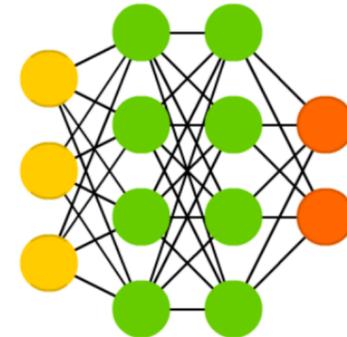


INFERÊNCIA

Entrada



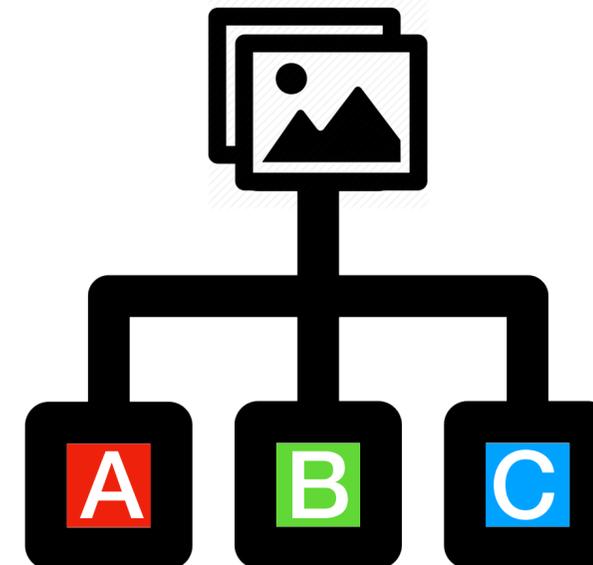
Rede neural
treinada

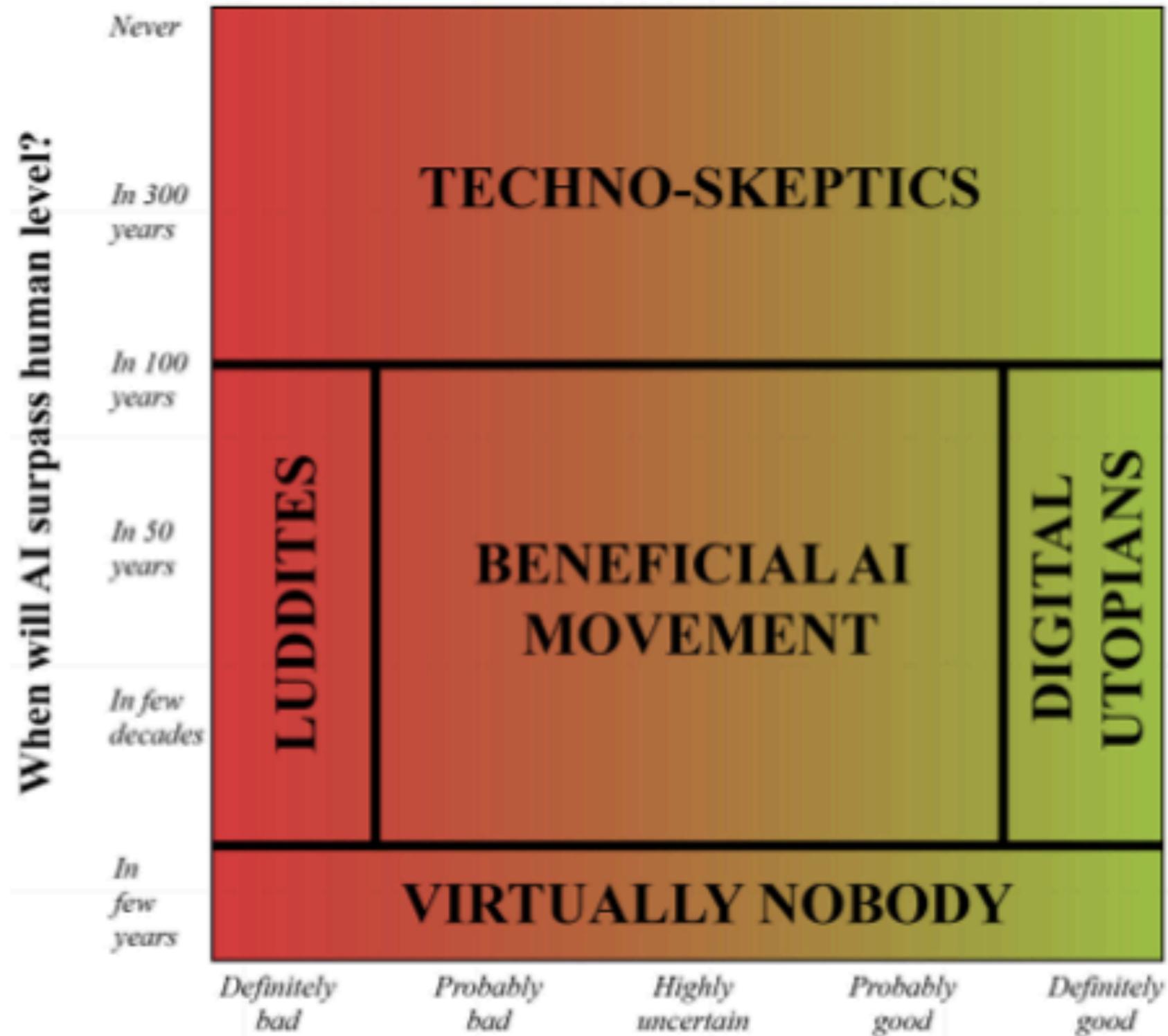


Computador



Classificação





If superhuman AI appears, will it be a good thing?

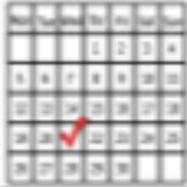
<p>Myth: Superintelligence by 2100 is inevitable</p> <p>Myth: Superintelligence by 2100 is impossible</p>		<p>Fact: It may happen in decades, centuries or never: AI experts disagree & we simply don't know</p>	
<p>Myth: Only Luddites worry about AI</p>		<p>Fact: Many top AI researchers are concerned</p>	
<p>Mythical worry: AI turning evil</p> <p>Mythical worry: AI turning conscious</p>		<p>Actual worry: AI turning competent, with goals misaligned with ours</p>	
<p>Myth: Robots are the main concern</p>		<p>Fact: Misaligned intelligence is the main concern: it needs no body, only an internet connection</p>	
<p>Myth: AI can't control humans</p>		<p>Fact: Intelligence enables control: we control tigers by being smarter</p>	
<p>Myth: Machines can't have goals</p>		<p>Fact: A heat-seeking missile has a goal</p>	
<p>Mythical worry: Superintelligence is just years away</p>	<p>PANIC!</p> 	<p>Actual worry: It's at least decades away, but it may take that long to make it safe</p>	<p>PLAN AHEAD!</p> 

Figure 1.5: Common myths about superintelligent AI.

Primeiros empregos que se tornarão obsoletos devido a IA

- Operadores de telemarketing**
- Contadores**
- Recepcionistas**
- Entregadores**
- Revisores e tradutores**
- Setor jurídico (assistentes etc)**
- Motoristas de caminhão**

Catalogue of fears

Probability of computerisation of different occupations, 2013
(1 = certain)

Job	Probability
Recreational therapists	0.003
Dentists	0.004
Athletic trainers	0.007
Clergy	0.008
Chemical engineers	0.02
Editors	0.06
Firefighters	0.17
Actors	0.37
Health technologists	0.40
Economists	0.43
Commercial pilots	0.55
Machinists	0.65
Word processors and typists	0.81
Real-estate sales agents	0.86
Technical writers	0.89
Retail salespeople	0.92
Accountants and auditors	0.94
Telemarketers	0.99

Source: "The Future of Employment: How Susceptible are Jobs to Computerisation?", by C. Frey and M. Osborne (2013)

O que foi previsto?

Superinteligência antes de 2100



**Geralmente futuros distópicos
IA torna-se maléfica**

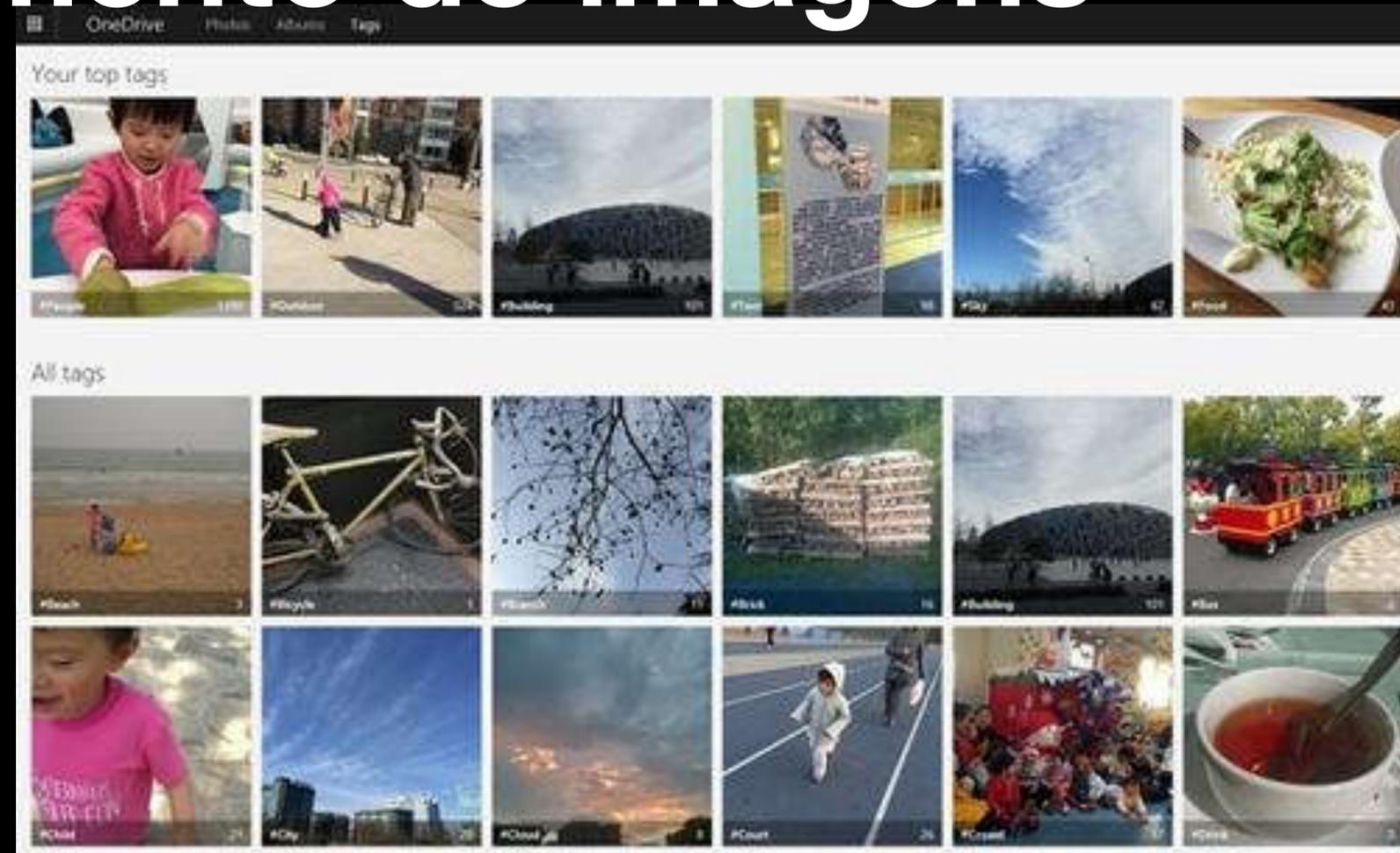


Robôs são a maior preocupação



Sugestão: Brotherton

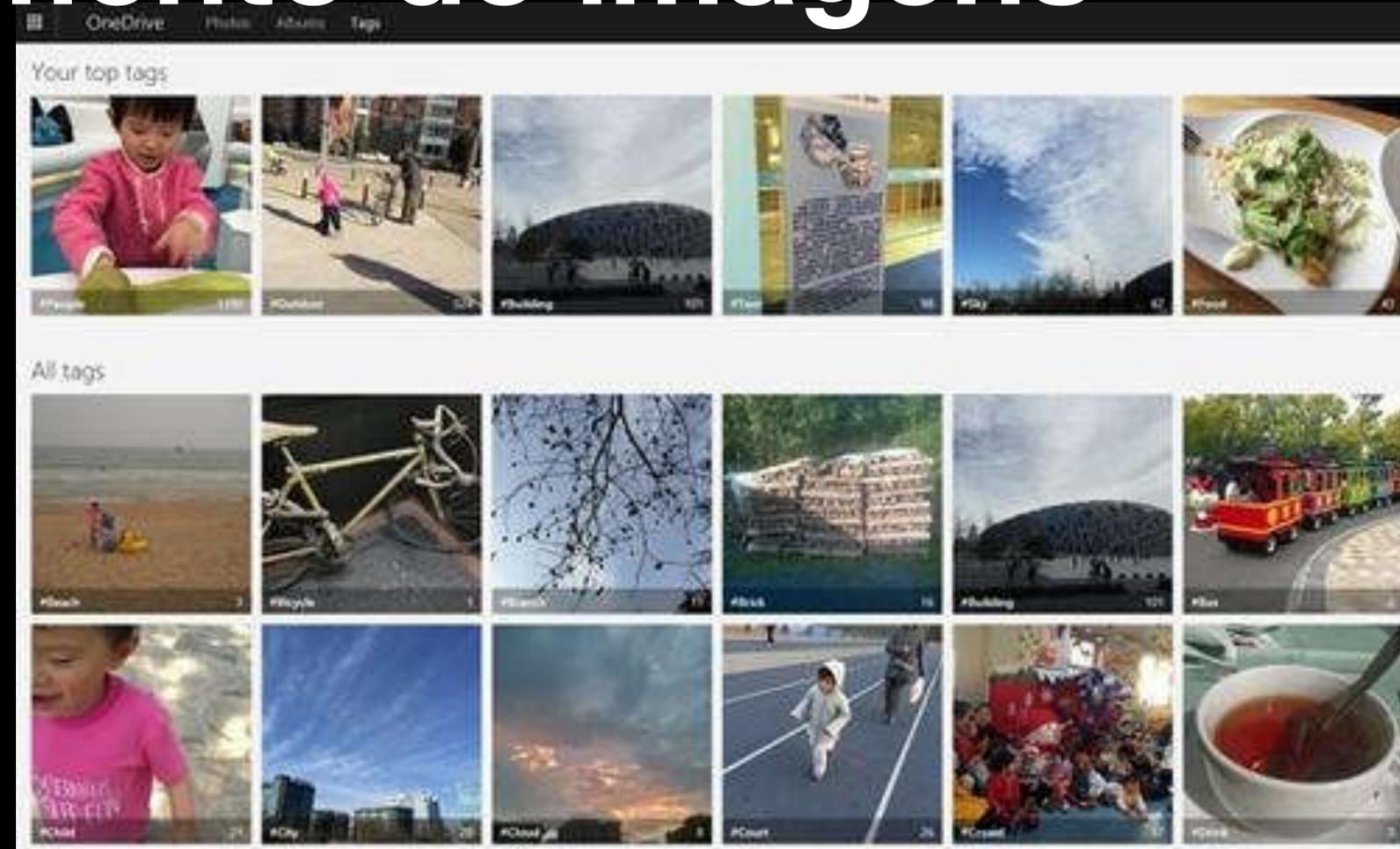
Reconhecimento de imagens



Taxa de erros: humanos 5.1%

IA 4.94%

Reconhecimento de imagens



designlines INDUSTRIAL CONTROL

News & Analysis

Microsoft, Google Beat Humans at Image Recognition

Deep learning algorithms compete at ImageNet challenge

R. Colin Johnson

2/18/2015 08:15 AM EST

14 comments



1 saves

LOGIN TO RATE

Taxa de erros: humanos 5.1%
IA 4.94%

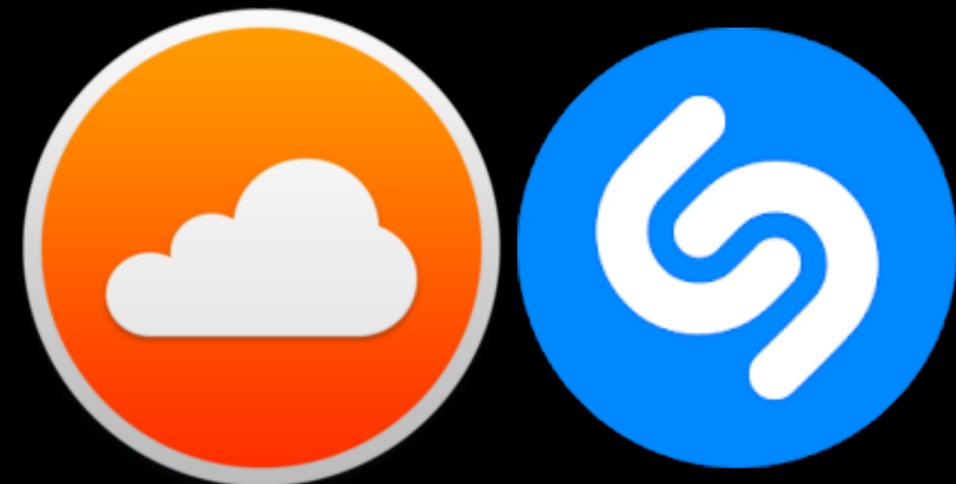
Algumas vitórias da IA

reconhecimento de linguagem natural

processar, interpretar e produzir linguagens naturais

exemplo: “pessoas que são gaúchas e astrofísicas e moram em São Paulo”

reconhecer músicas





Cluster de GPUs para ciência