Inteligência Artificial:

Ciência, Negócios e Ética

Luis Lamb, Ph.D.

Novembro de 2018

Pró-Reitor de Pesquisa - UFRGS

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Sumário

Um pouco de História

I.A., computação e impactos sociais

Business: “Reality checks”

Reflexões

Warning: conteudismo

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Porto Alegre, Rio Grande do Sul, Brazil

- RS: 11.2 million people
- Roughly the size of Britain
- Life exp. 76.9 (2010)
- HDI 0.746 (76th)
- 4th GDP in Brazil ~100B US$

- Capital of the state
- 1.47 million people
- 11th largest city in Brazil
- High tech industry (3rd/4th in BR)
- Three large universities

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Instituto de Informática, UFRGS

- 73 full-time faculty/2 part-time; 55 supervisors in PhD program
- Faculty **PhD backgrounds**:
  Brazil(26 - 4 Universities), France(14/5), Germany(8/5), UK(6/4), Scotland*(1), USA(4/3), Canada(2/2), Belgium(2/2), Sweden (1), Switzerland(2), Portugal(2/2)
- *PostDocs:* 15 US, 8 FR, 6 UK, 2 CAN, 3+ DE, IT, ND, BE, DN

Computer Science & CSEng (BSc): Top rankings, 900+ students

(Post)graduate Programme in CS

Currently: 300 students (MSc and PhD)

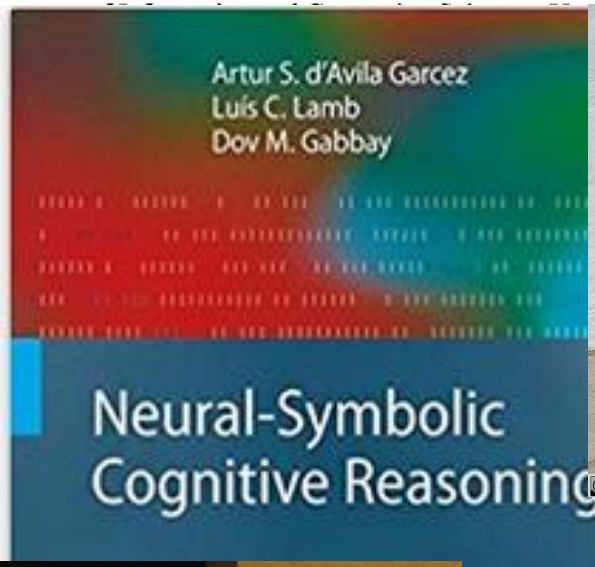
Graduated over 250 PhDs and 1400 MSc.

Who is this guy?

A Neural-Symbolic Cognitive Agent for Online Learning and Reasoning

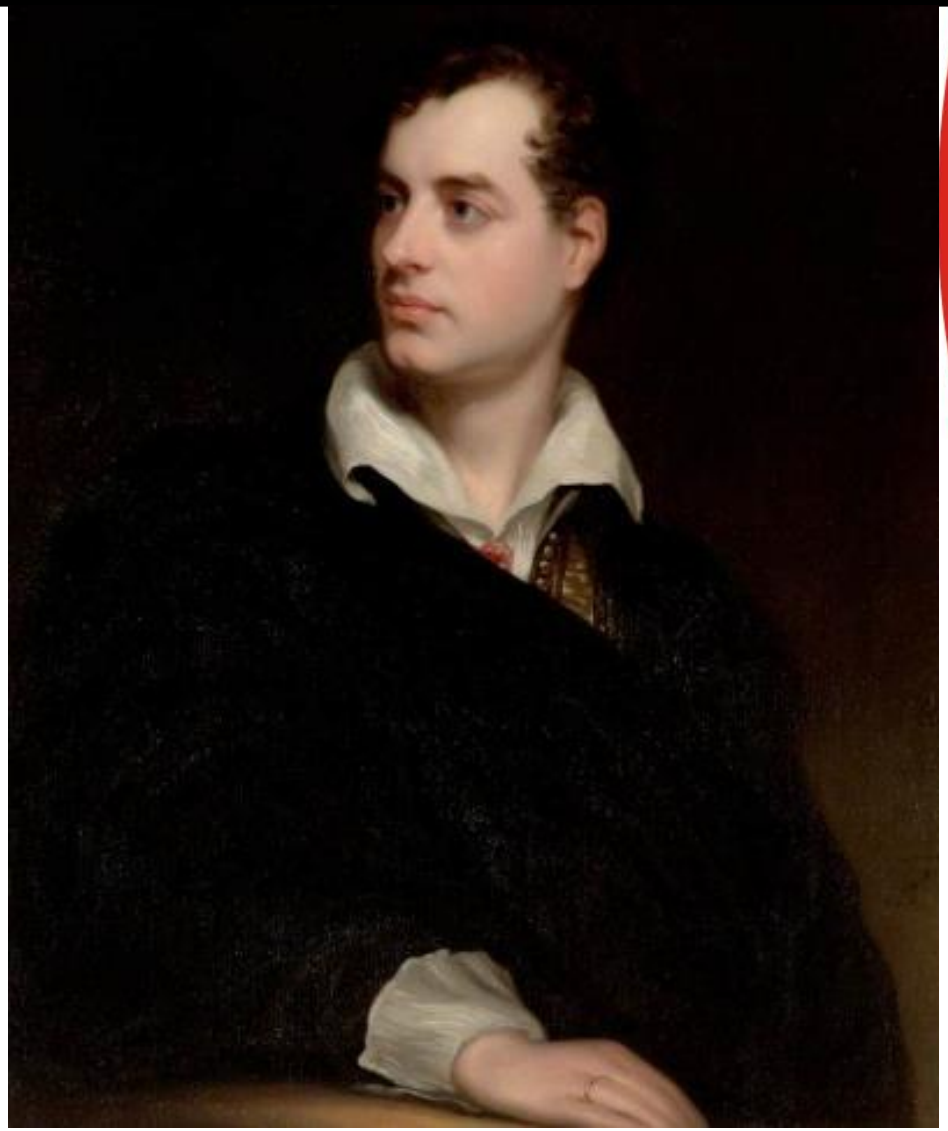
H.L.H. (Leo) de Penning[1], A.S. d'Avila Garcez[2], Luís C. Lamb[3], John-Jules C. Meyer[4]

[1]TNO Behaviour and Societal Sciences, Soesterberg, The Netherlands, leo.depenning@tno.nl
[2]Department of Computing, City University, London, UK, aag@soi.city.ac.uk
[3]Instituto de Informática, UFRGS, Porto Alegre, Brazil, lamb@inf.ufrgs.br



Poesia e IA

Lord Byron, FRS



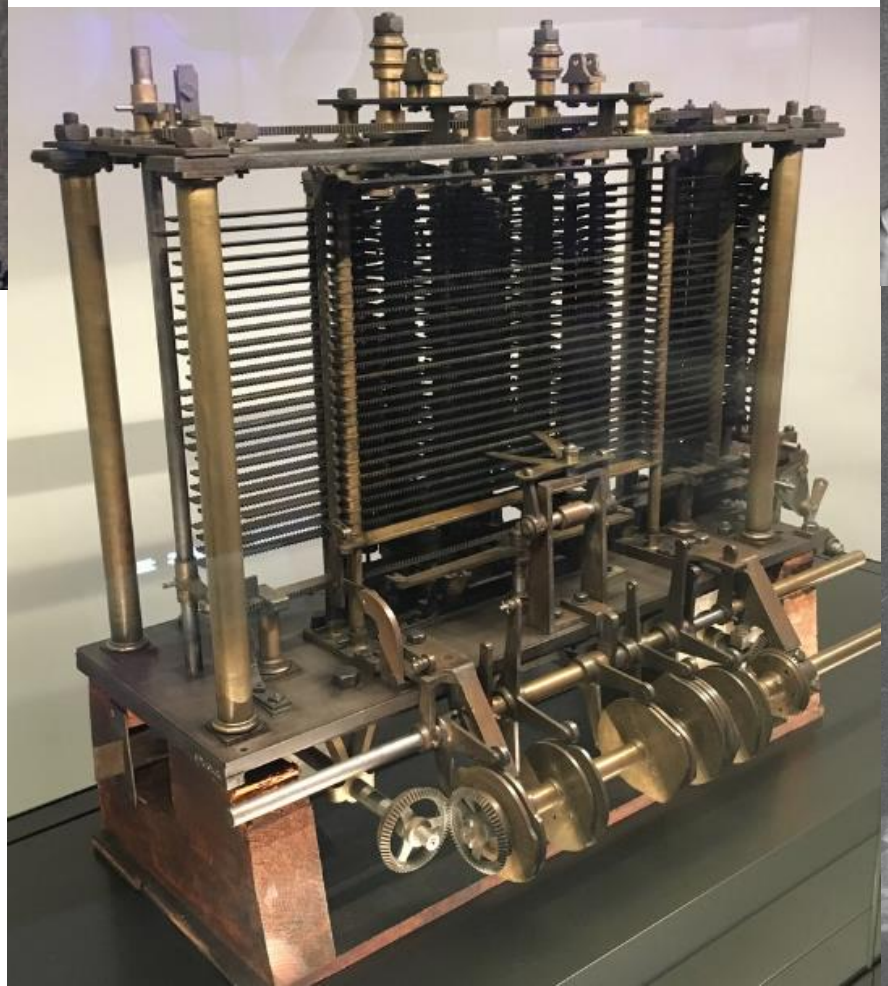
In solitude, where we are least alone.

Lord Byron, c. 1813 by Thomas Phillips, Wikipedia,

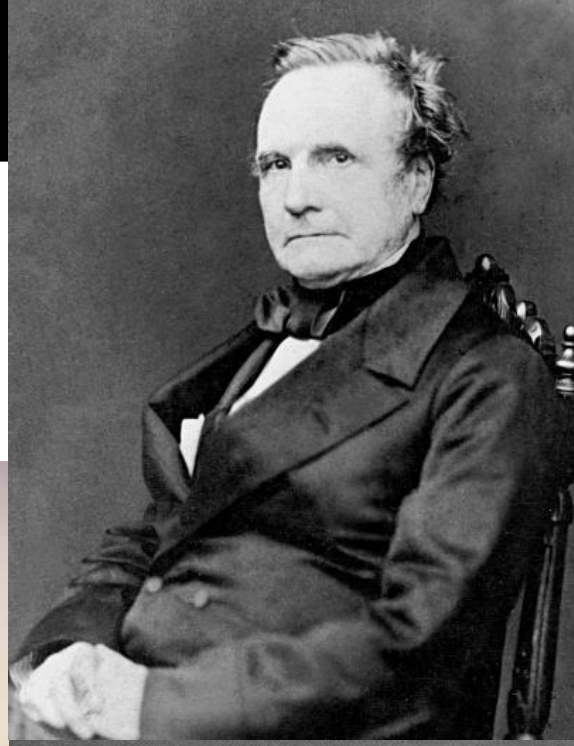
Poesia e IA

Augusta Ada King, Countess of Lovelace, *née* **Byron,** the first computer programmer

Charles Babbage, FRS



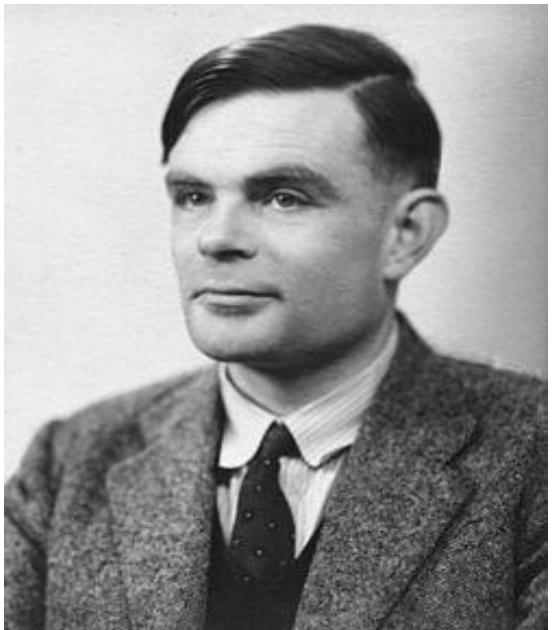
Analytical engine (1822-31),
difference engine



Enters Turing

The whole thinking process is still rather mysterious to us, but I believe that the attempt to make a thinking machine will help us greatly in finding out how we think ourselves.

Alan Turing, 15 May 1951, “Can Digital Machines Think” BBC.



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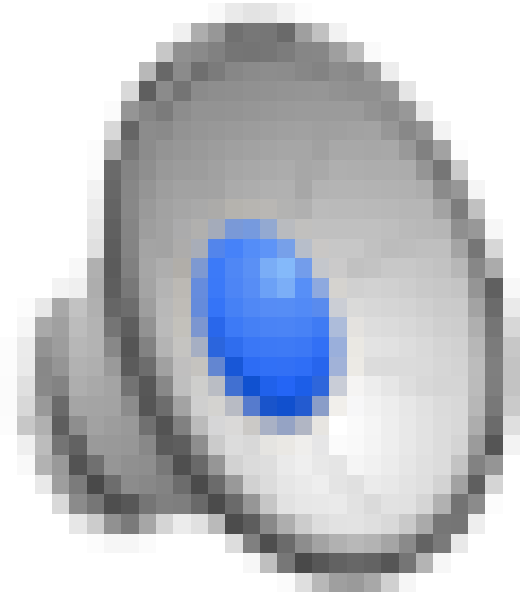
Inovação em Computação/TI

Turing's contributions: WWII impact

The Bombe, Bletchley Park

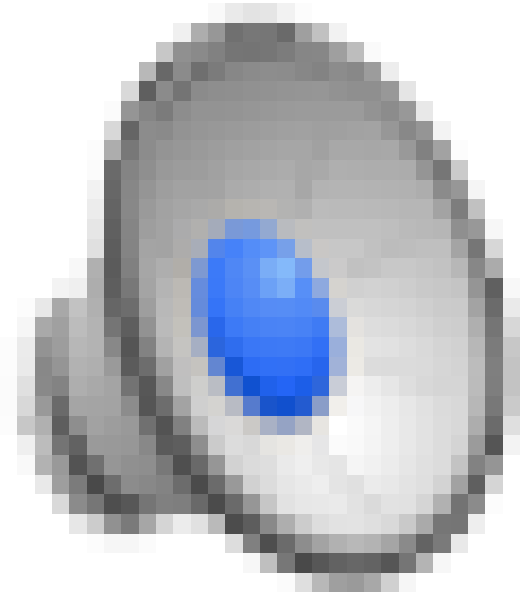


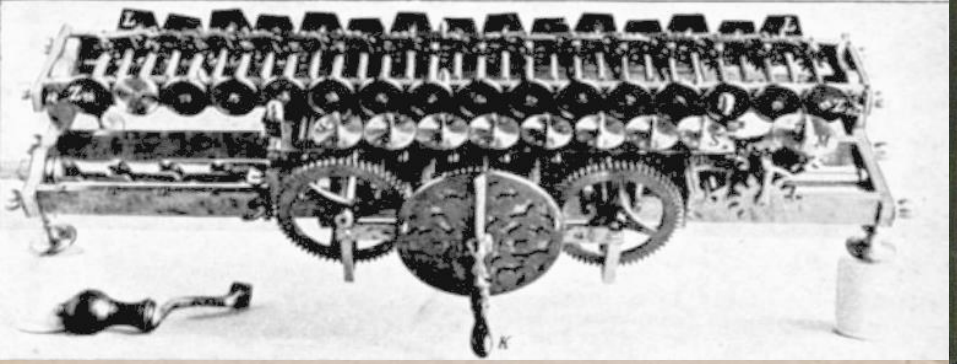
Slides by Luis C. Lamb

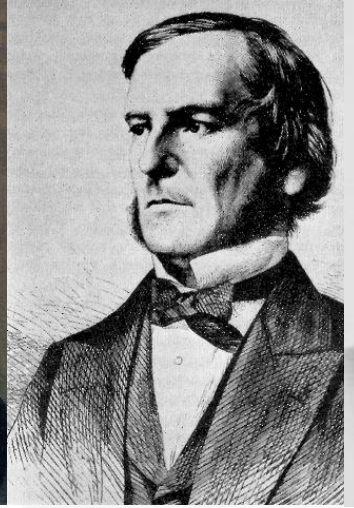
The Colossus, Bletchley Park,

Thomas Flowers, 1943-45

The Colossus, rebuilt







MSS. and other Communications for the Editor should be addressed to
Prof. G. RYLE, Magdalen College, Oxford.

VOL. LIX. No. 236. OCTOBER, 1950

MIND

A QUARTERLY REVIEW

OF

PSYCHOLOGY AND PHILOSOPHY

EDITED BY

PROF. GILBERT RYLE

WITH THE CO-OPERATION OF PROF. SIR F. C. BARTLETT AND PROF. C. D. BROAD

CONTENTS.

A Proposal for the

DARTMOUTH SUMMER RESEARCH PROJECT ON ARTIFICIAL INTELLIGENCE

June 17 - Aug. 16

We propose that a 2 month, 10 man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.

The following are some aspects of the artificial intelligence problem:

1) Automatic Computers

If a machine can do a job, then an automatic calculator can be programmed to simulate the machine. The speeds and memory capacities of present computers may be insufficient to simulate many of the higher functions of the human brain, but the major obstacle is not lack of machine capacity, but our inability to write programs taking full advantage of what we have.

2) How Can a Computer be Programmed to Use a Language

It may be speculated that a large part of human thought consists of manipulating words according to rules of reasoning

MIND

A QUARTERLY REVIEW

OF

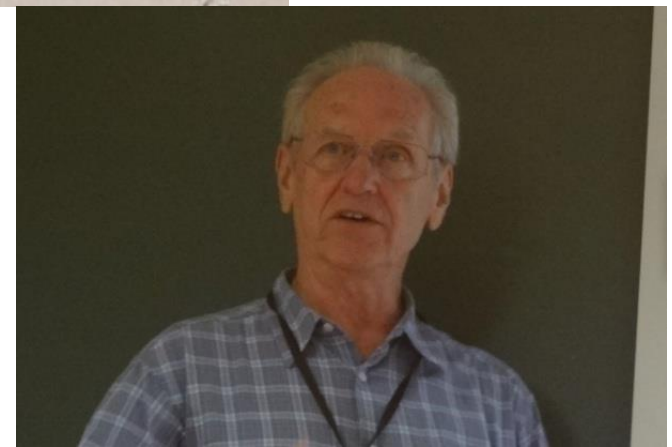
PSYCHOLOGY AND PHILOSOPHY

I.—COMPUTING MACHINERY AND INTELLIGENCE

BY A. M. TURING

1. *The Imitation Game.*

I PROPOSE to consider the question, 'Can machines think?' This should begin with definitions of the meaning of the terms 'machine' and 'think'. The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words 'machine'



Perspectiva histórica

Reasoning, connectionism, learning (… Minsky's confocal microscope, '57)

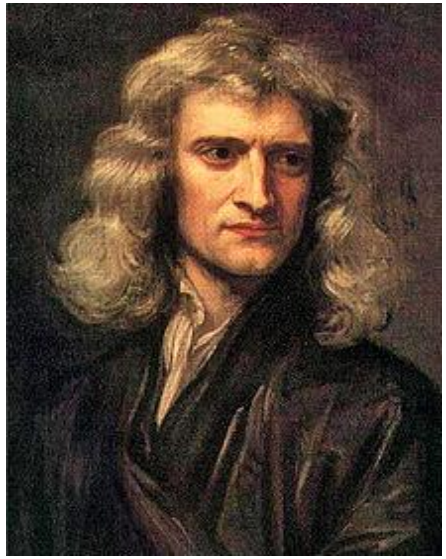
Reasoning + Learning

Turing, Minsky, McCarthy, Newell, Simon, Feigenbaum, Reddy, Valiant, Pearl, Hinton.

Aprendendo a raciocinar e criar

Impactos da Ciência

VS



Google

Google Search I'm Feeling Lucky

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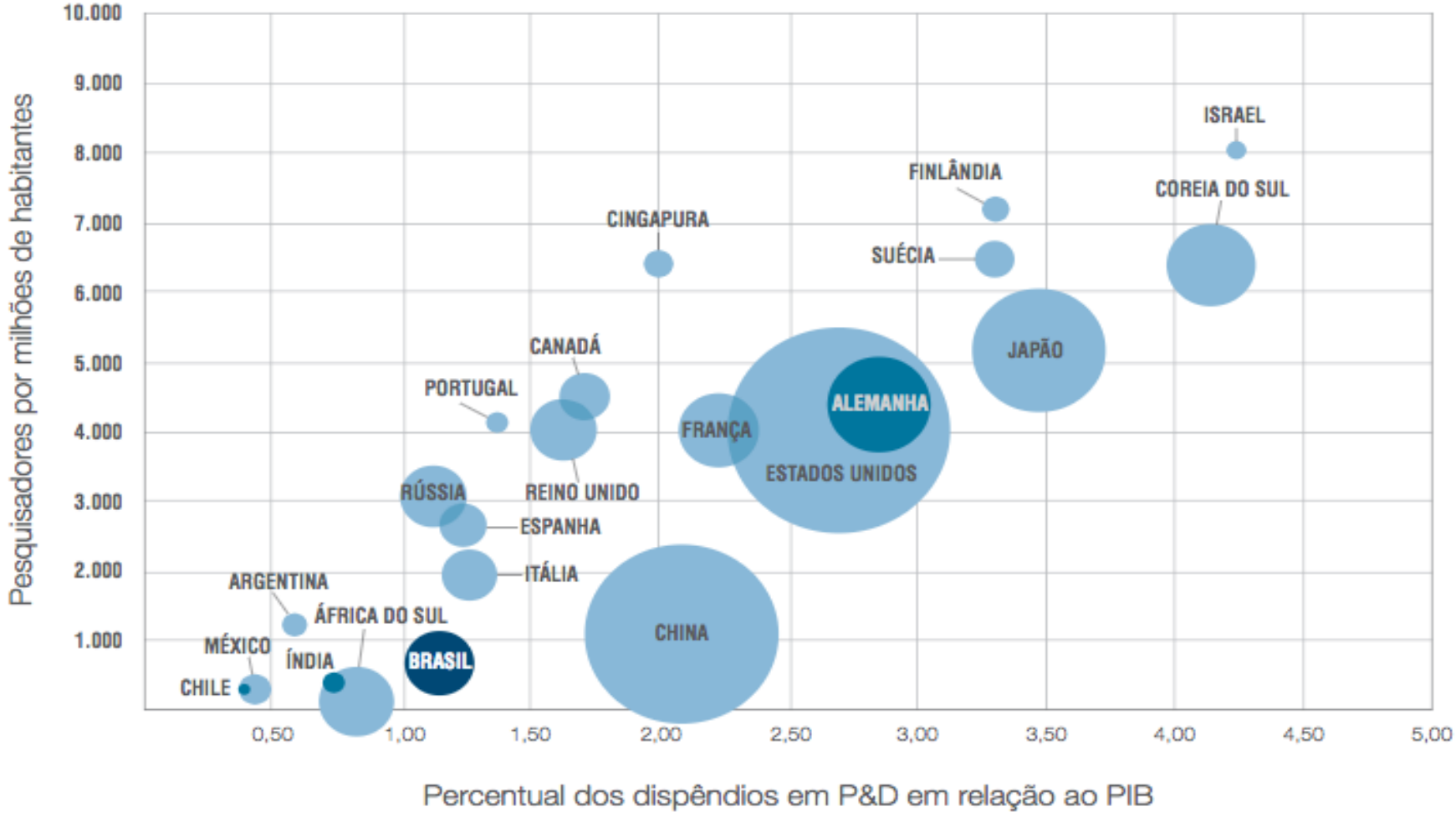
Dispêndio em CT&I - OECD

Fonte:
MCTIC
- ENCTI



Fonte: OECD, Main Science and Technology Indicators 2015/1; Índia: Institute for Statistics, UNESCO; Brasil: MCTI.
Obs. 1: O tamanho dos círculos indicam o dispêndio em P&D em bilhões de US$ correntes de PPC.
Obs. 2: Foram utilizados os últimos dados disponíveis para cada país.

FIGURA 12 – Dispêndios e recursos humanos em P&D

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Investimento Global em CT&I e Educação – "ou"exclusivo

Dados da OECD (2017), ***Public spending on education (indicator).*** *doi: 10.1787/f99b45d0-en (Accessed on 21 April 2017, 05 Nov. 2018)*

- ***Brasil****: Ensino Superior (ES)****: 3.3%*** ***do investimento público total.***
  (0.96% PIB, 2015)
- *Ensino* ***não-superior*** *(ENS):*
  12.8% do investimento público total
  (4.1% PIB, 2015)
- ***México: ES 4% ENS: 13.3%***
- ***Chile: ES 4.5% ENS: 10.4%***
- ***EUA: ES 3.4% ENS: 8.2%***
- ***Brasil: 3.3% e 12.8% (não superior)***
  - ***OECD: ES: 3.1% ENS: 8%***
  - ***Coréia do Sul: ES: 3.1& ENS: 9.7%***

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- *Dados da OECD.*

China spent an estimated $279 billion on R&D last year

- China's total spending on research and development is estimated to have hit 1.76 trillion yuan ($279 billion) last year — a year-on-year increase of 14 percent and a rise of 70.9 percent from 2012.
- China has established dozens of new high-tech industrial parks and incubators aimed at promoting technologies such as artificial intelligence, robotics and big data.
- Wan told reporters that China was aiming to bring output of electric vehicles up to 2 million units by 2020, double the estimated volume for this year.

Published 7:49 PM ET Mon, 26 Feb 2018

REUTERS

Patentes no Brasil – Dados do INPI

INPI INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL

Ranking dos Depositantes Residentes de Patentes de Invenção (PI)

Rank	Nome	2015	Part. no Total Residentes (%)
1	WHIRLPOOL S.A.	90	1,9
2	UNIVERSIDADE FEDERAL DE MINAS GERAIS	56	1,2
3	UNIVERSIDADE ESTADUAL DE CAMPINAS - UNICAMP	52	1,1
4	UNIVERSIDADE FEDERAL DO PARANA	50	1,1
5	PETRÓLEO BRASILEIRO S.A. - PETROBRAS	48	1,0
6	UNIVERSIDADE DE SAO PAULO	44	0,9
7	FUNDACAO CPQD - CENTRO DE PESQUISA E DESENVOLVIMENTO EM TELECOMUNICACOES	37	0,8
8	UNIVERSIDADE ESTADUAL PAULISTA JULIO DE MESQUITA FILHO	33	0,7
9	VALE S.A.	32	0,7
10	UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL	32	0,7
11	UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE	28	0,6
12	UNIVERSIDADE FEDERAL DE PERNAMBUCO	27	0,6
13	UNIVERSIDADE FEDERAL DO CEARÁ	25	0,5
14	OKI BRASIL INDÚSTRIA E COMÉRCIO DE PRODUTOS E TECNOLOGIA EM AUTOMAÇÃO S.A.	25	0,5
15	UNIVERSIDADE FEDERAL DE SANTA MARIA	23	0,5
16	UNIVERSIDADE TECNOLOGICA FEDERAL DO PARANA		
17	UNIVERSIDADE FEDERAL DA BAHIA		
18	UNIVERSIDADE FEDERAL DO PARÁ		
19	UNIVERSIDADE FEDERAL DA PARAIBA		
20	UNIVERSIDADE FEDERAL DE SANTA CATARINA		

USPTO 2015

1. IBM, headquartered in Armonk, New York
2. Samsung Electronics Co., headquartered in Suwon, Korea
3. Canon Kabushiki Kaisha, headquartered in Tokyo, Japan
4. QUALCOMM INC.
5. GOOGLE, INC.
6. Toshiba Corporation, headquartered in Tokyo, Japan
7. Sony Corporation, headquartered in Tokyo, Japan
8. LG ELECTRONICS INC., headquartered in Seoul, Korea
9. Intel Corporation, headquartered in Santa Clara, California
10. Microsoft Corporation, headquartered in Redmond, Washington

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Hypes and Hopes: AI + Computer Science Today

UK launches £1bn AI fund at Imperial College London

by Stephen Johns
26 April 2018

The deal, announced by Business Secretary Greg Clark and Digital Secretary Matt Hancock, will fund 1,000 new government AI PhDs to keep the UK at the forefront of innovation and build the UK's status as an AI research hotspot.

SCIENCE NEWS MARCH 29, 2018 / 10:36 AM / 2 MONTHS AGO

France to spend $1.8 billion on AI to compete with U.S., China

WOMEN@FORBES MAR 20, 2018 @ 01:22 PM 4,644 The Little Bla

AI And The Future Of Work: Will Our Jobs Disappear?

ALEX DAVIES TRANSPORTATION 05.24.18 04:23 PM

THE UNAVOIDABLE FOLLY OF MAKING HUMANS TRAIN SELF-DRIVING CARS

CSAIL

CSAIL at MIT
@MIT_CSAIL Follows you

Yann LeCun @ylecun · May 23
At Facebook-Paris, celebrating the third anniversary of FAIR-Paris, with Mark Zuckerberg, Cédric Villani, Frédérique Vidal, Stanislas Dehaene, Antoine Bordes and many representatives of the AI ecosystem in France at Facebook-Paris.

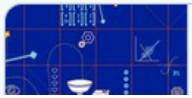
You Retweeted

Erik Brynjolfsson @erikbryn · 12h
My conversation with Danny Kahneman: Should algorithms be in the driver's seat? mitsloan.mit.edu/newsroom/artic… via @mitsloan #MPCBook @mit_ide

Andrew Ng @Andr
Can your AI model detect abnormalities in bone X-rays as well as a radiologist?

My @Stanford lab just released a new dataset, MURA. Join our deep learning competition to see how your model compares: stanfordmlgroup.github.io /competitions/m…

Machine Learning @machinelearnflx · 34m
Mathematics for Machine Learning zpy.io/3510c290 #machinelearning #ad



Mathematics for Machine Learning | Coursera
Mathematics for Machine Learning from Imperial College

Ronald van Loon @Ronald_vanLoon · 5m
What's the Difference Between #ArtificialIntelligence, #MachineLearning, and #DeepLearning?
by @mvc |

You Retweeted

WIRED UK @WiredUK · Oct 27
Self-driving cabs on the streets of London by 2021 was just too good to be true

Steven Pinker @sapinker · May 19
"A.I. Is Harder Than You Think": Beyond the usual hype, a penetrating analysis by experts @GaryMarcus and Ernest Davis.

Complexidade Econômica

Fonte:
http://atlas.cid.harvard.edu/rankings/

Ranking, 2015.

The ATLAS of Economic Complexity,
Center for International Development,
Harvard University.

Acesso em 04 Set. 2017.

20	SGP	Singapore	1.20507	- 0
21	KOR	Korea, Rep.	1.18708	- 0
22	CAN	Canada	1.08083	▲1
23	HUN	Hungary	1.03549	▲1
24	GEO	Georgia	0.93156	▲20
25	MEX	Mexico	0.88822	▼-3
26	POL	Poland	0.86506	▲2
27	HRV	Croatia	0.85975	- 0
28	BRA	Brazil	0.74433	▲4
29	HKG	Hong Kong	0.65567	▼-3
30	ROU	Romania	0.62553	▼-1
31	NOR	Norway	0.60427	▲2
32	BIH	Bosnia and Herzegovina	0.5996	▼-7
33	EST	Estonia	0.52451	▲13
34	BGR	Bulgaria	0.48114	▲4
35	BLR	Belarus	0.47167	▼-4
36	MDA	Moldova	0.4122	▲9
37	MYS	Malaysia	0.40735	▲3

39	SRB	Serbia	0.5332	▲2
40	BGR	Bulgaria	0.44287	- 0
41	BIH	Bosnia and Herzegovina	0.43977	▼-5
42	TUR	Turkey	0.33331	▲1
43	SAU	Saudi Arabia	0.30741	▲14
44	UKR	Ukraine	0.26008	▼-2
45	RUS	Russia	0.21483	▲6
46	LBN	Lebanon	0.12467	▼-2
47	BRA	Brazil	0.10876	▲5
48	IND	India	0.09917	▲2
49	NZL	New Zealand	0.08889	▲5
50	TUN	Tunisia	0.06476	▼-5
51	CRI	Costa Rica	0.06395	▼-2
52	AGO	Angola	0.02983	▲57
53	QAT	Qatar	0.0213	▲32
54	ARE	United Arab Emirates	0.00823	▼-7
55	URY	Uruguay	-0.00557	▼-7

1995

The Economic Complexity Index (ECI) and the Product Complexity Index (PCI) are, respectively, measures of the relative knowledge intensity of an economy or a product.
Harmonized System Classification (HS4) maintained by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) dating back to 1995.

HS4 Product Rankings (2015)

« Previous Year

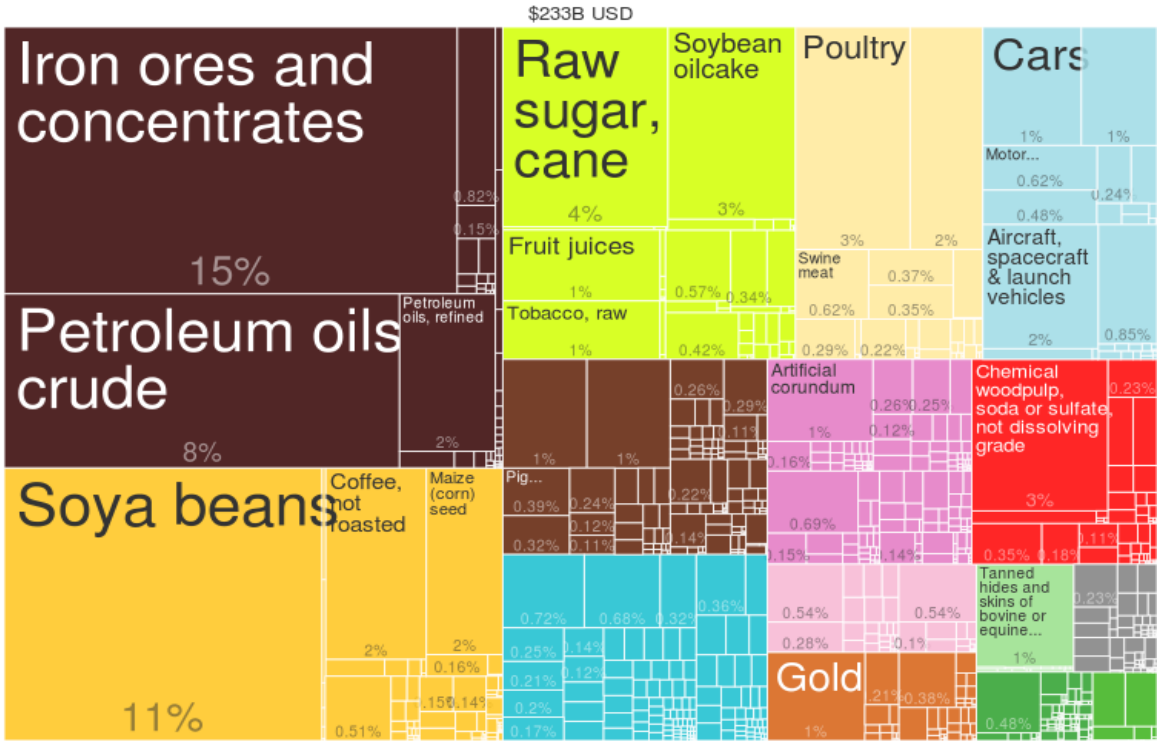
2015

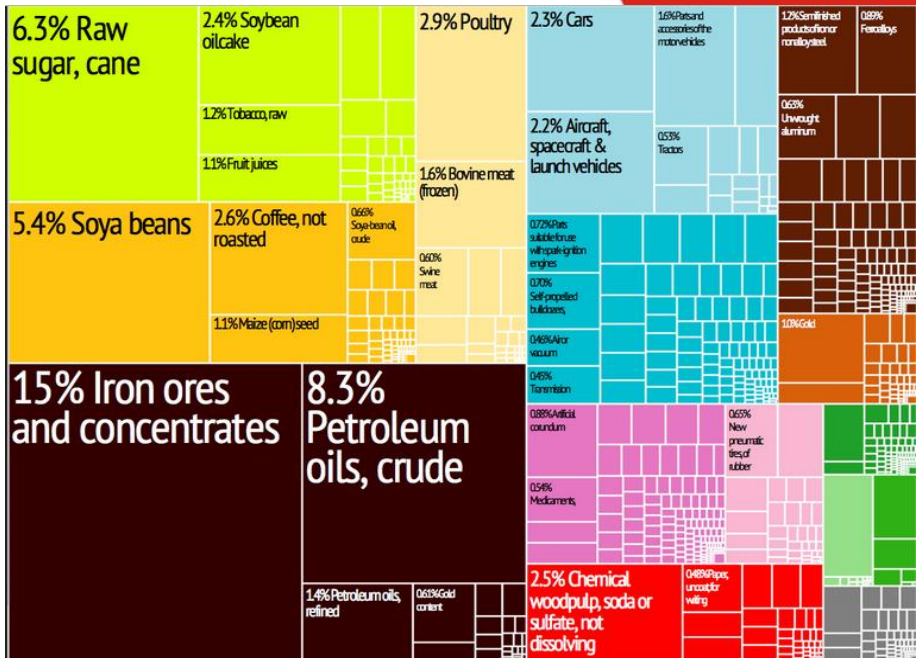
Rank	HS4 Code	Product
1	7417	Copper cooking products
2	0503	Horsehair
3	8113	Cermets
4	8457	Machining centers for working metal
5	8005	Tin foil (thickness < 0.2 mm)
6	9010	Equipment for photographic laboratories
7	2929	Compounds with other nitrogen function
8	9022	Apparatus based on the use of X-rays or of alpha, beta or gamma radiatio
9	9012	Microscopes other than optical microscopes
10	8209	Tool plates/tips/etc, sintered metal carbide & cermet
11	8461	Machine tools for planing, shaping, slotting, gear cutting, or sawing
12	3707	Chemical preparations for photographic uses
13	9027	Instruments and apparatus for physical or chemical analysis
14	9017	Drafting tables and machines
15	8456	Machines for the removal of material by laser or other optic means
16	7803	Lead bars, rods, profiles and wire
17	3911	Petroleum resins, coumarone-indene resins, polyterpenes, polysulfides, polysulfones	4.6755	-3

1222	2610	Chromium ore	-3.12768	▲2
1223	4106	Tanned skins of other animals	-3.20676	▲11
1224	1301	Lac	21689	▲5
1225	4601	Plaits and products of plaiting materials	198	▼-36
1226	5310	Woven fabrics of jute or of other textile bast fibers	-3.24366	▲9
1227	2709	Petroleum oils, crude	-3.35806	▲3
1228	6505	Hats, knitted or crocheted	-3.38287	▼-30
1229	5201	Cotton raw	-3.3829	▲2
1230	1801	Cocoa beans, whole	-3.53719	▼-4
1231	0801	Coconuts, Brazil nuts and cashew nuts	-3.62016	▲7
1232	6503	Felt hats	-3.67163	▼-451
1233	0714	Manioc (cassava)	-3.7156	▲3
1234	4001	Natural rubber	-4.02793	▲5
1235	2615	Niobium (columbium), tantalum, vanadium or zirconium ores	-4.11353	▼-8
1236	6704	Wigs	-4.20031	▼-4
1237	2609	Tin ores	-4.21129	▼-9
1238	5307	Yarn of jute or other textile bast fibers	-4.22236	▼-1
1239	5303	Jute and other textile fibers	-4.38048	▲1

Exportações Brasileiras/Complexidade Econômica

Brazil Export Treemap from MIT Harvard Economic Observatory: 29 March 2014, 2012.





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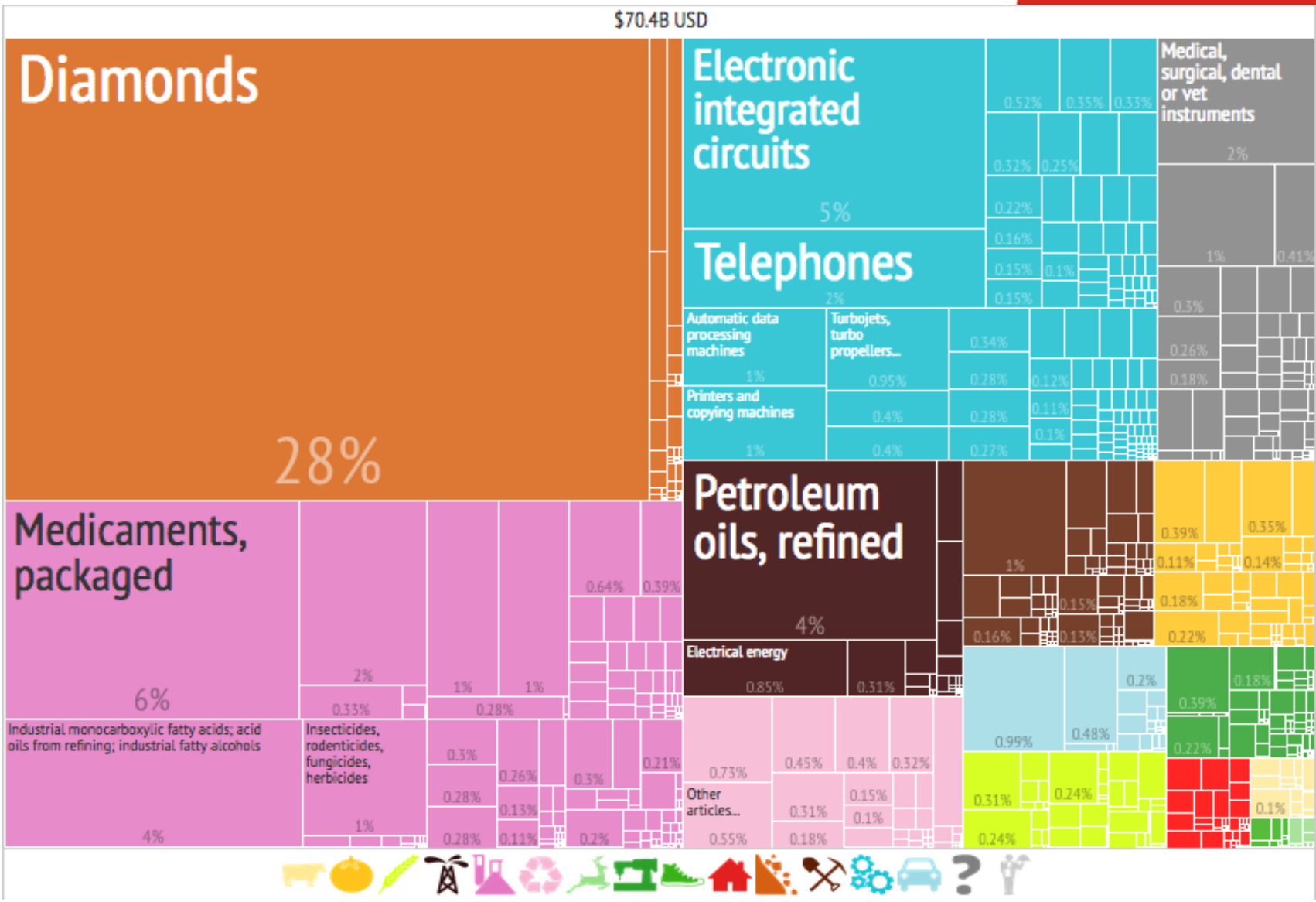
Exportações Israelenses

Israel Exports by Product (2014) from Harvard Atlas of Economic Complexity



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CS/AI Today

DeepMind

AlphaZero AI beats champion chess program after teaching itself in four hours

Google's artificial intelligence sibling DeepMind repurposes Go-playing AI to conquer chess and shogi without aid of human knowledge

ephen Hawking, Elon Musk, and Bill Gates. (Photo: Getty Images)

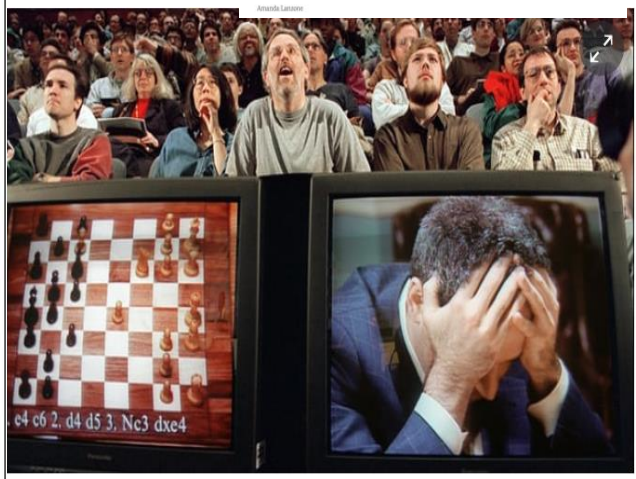
Machine learning: the power and promise of computers that learn by example
Issued: April 2017 DES4702
ISBN: 978-1-78252-259-1

The New York Times

The Opinion Pages | OP-ED CONTRIBUTOR

Robot Weapons: What's the Harm?

By JERRY KAPLAN AUG. 17, 2015



Chess enthusiasts watch World Chess champion Garry Kasparov on a television monitor in 1997. Photograph: Stan Honda/AFP/Getty Images

Lições do Passado

BBC News: 23 Feb 2000

BBC NEWS

You are in: Talking Point

Front Page
World
UK
UK Politics
Business
Sci/Tech
Health
Education
Sport
Entertainment
Talking Point
Forum
In Depth
AudioVideo

Wednesday, 23 February, 2000, 14:30 GMT

E-commerce: Will it change your life?

E-commerce has the High Street stores worried about the future of shopping. Every day more of us are turning to the internet to order anything from CDs to cars, food to flights.

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Advanced search options

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  UK logs on to e-commerce
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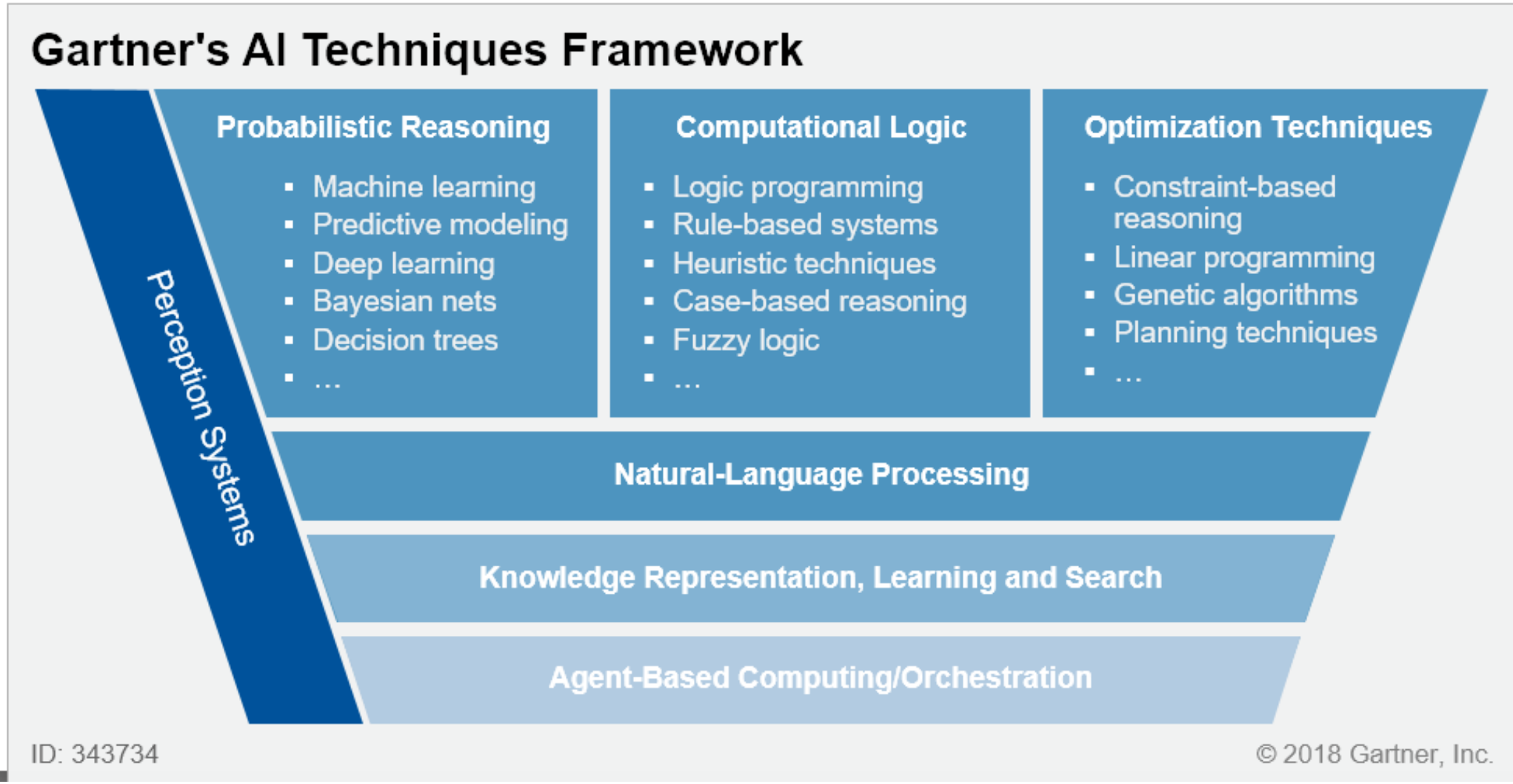
Everett Collection

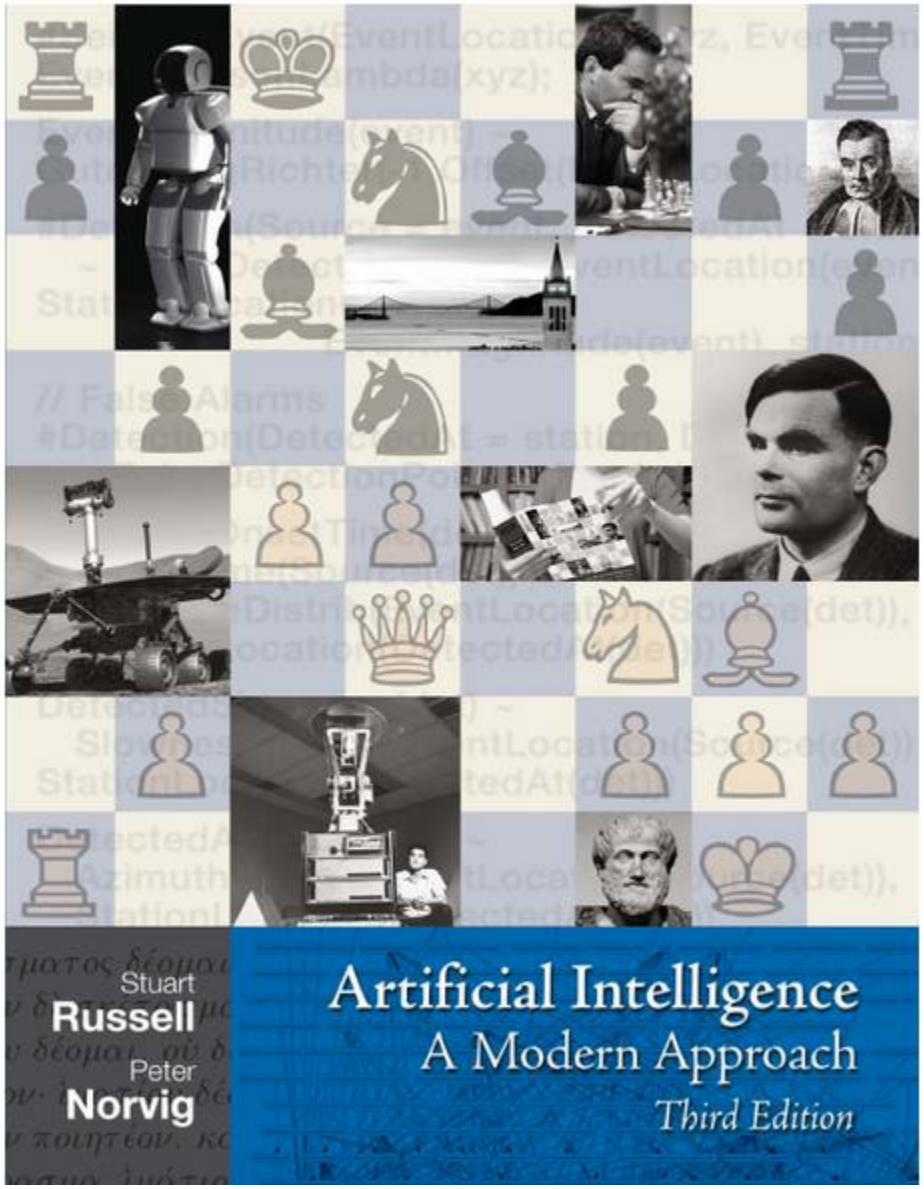
AI Today: The Gartner Perspective



Inspired by Stuart Russell and Peter Norvig: "Artificial Intelligence: A modern approach."

Gartner: Artificial Intelligence Hype: Managing Business Leadership Expectations
Published 5 June 2018, ID G00343734 - 13 min read

The Gartner Perspective and the Real World... what ***you need to know***



Gartner: Artificial Intelligence Hype: Managing Business Leadership Expectations
Published 5 June 2018, ID G00343734 - 13 min read

The hard work underlying the beauty of AI and Machine Learning

LEARNING INTERNAL REPRESENTATIONS

BY ERROR PROPAGATION

David E. Rumelhart, Geoffrey E. Hinton, and Ronald J. Williams

September 1985

ICS Report 8506

change in the output as a function of changes in the input. Thus, we have

$$\delta_{pj} = -\frac{\partial E_p}{\partial net_{pj}} = -\frac{\partial E_p}{\partial o_{pj}} \frac{\partial o_{pj}}{\partial net_{pj}}.$$

Let us compute the second factor. By Equation 8 we see that

$$\frac{\partial o_{pj}}{\partial net_{pj}} = f'_j(net_{pj}),$$

which is simply the derivative of the squashing function f_j for the jth unit, eval that unit. To compute the first factor, we consider two cases. First, assume th the network. In this case, it follows from the definition of E_p that

$$\frac{\partial E_p}{\partial o_{pj}} = -(t_{pj} - o_{pj}),$$

which is the same result as we obtained tion 12, we get

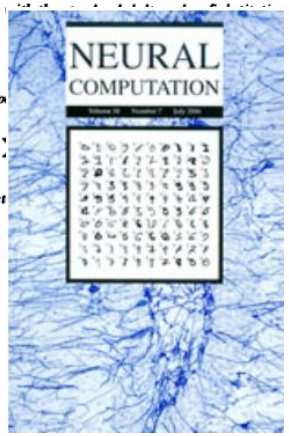
$$\delta_{pj} = (t_{pj} - o_{pj}) f'_j(net_{pj})$$

for any output unit u_j. If u_j is not an o

$$\sum_k \frac{\partial E_p}{\partial net_{pk}} \frac{\partial net_{pk}}{\partial o_{pj}} = \sum_k \frac{\partial E_p}{\partial net_{pk}} \frac{\partial}{\partial o_{pj}}$$

In this case, substituting for the two fact

$$\delta_{pj} = f'_j(net_{pj}) \sum_k \delta_{pk} w_{kj}$$



A Fast Learning Algorithm for Deep Belief Nets

Geoffrey E. Hinton
hinton@cs.toronto.edu
Simon Osindero
osindero@cs.toronto.edu
Department of Computer Science, University of Toronto, Toronto, Canada M5S 3G4

Yee-Whye Teh
tehyw@comp.nus.edu.sg
Department of Computer Science, National University of Singapore, Singapore 117543


```
\% PERFORM A BOTTOM-UP PASS TO GET WAKE/POSITIVE PHASE
\% PROBABILITIES AND SAMPLE STATES
wakehidprobs = logistic(data*vishid + hidrecbiases);
wakehidstates = wakehidprobs > rand(1, numhid);
wakepenprobs = logistic(wakehidstates*hidpen + penrecbiases);
wakepenstates = wakepenprobs > rand(1, numpen);
                                    ates*pentop + targets*labtop +

                                    d(1, numtop);
```

COGNITIVE SCIENCE

UCSD

Letters

A Fast Learning Algorithm for Deep Belief Nets
Geoffrey E. Hinton, Simon Osindero, and Yee-Whye Teh
Neural Computation July 2006, Vol. 18, No. 7, pp. 1527–1554

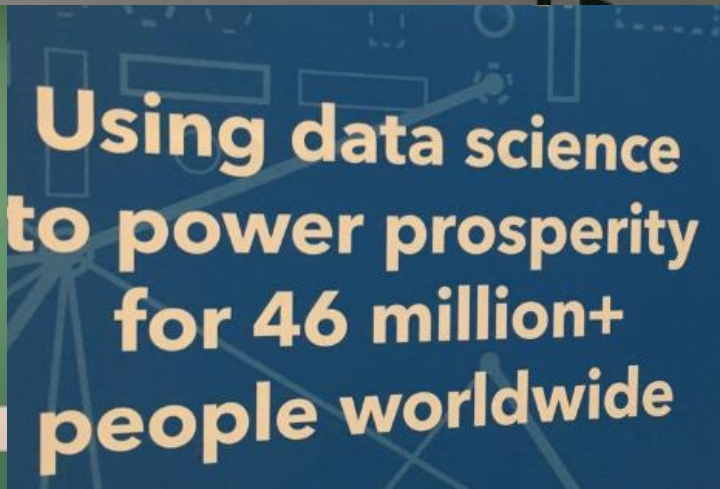
Abstract PDF (769 KB) PDF Plus (1619 KB)

A Connectionist Computational Model for Epistemic and Temporal Reasoning
Artur S. d'Avila Garcez and Luís C. Lamb
Neural Computation July 2006, Vol. 18, No. 7, pp. 1711–1738

Abstract PDF (207 KB) PDF Plus (257 KB)

13/07/2018 – IJCAI conference – future of fintechs – “techfins?”

13/07/2018 – IJCAI conference



Singularity University SU for En

SingularityHub

TOPICS IN FOCUS EX

Topics

Moshe Vardi: Robots Could Put Humans Out of Work by 2045

By **Jason Dorrier** - May 15, 2013 30,965

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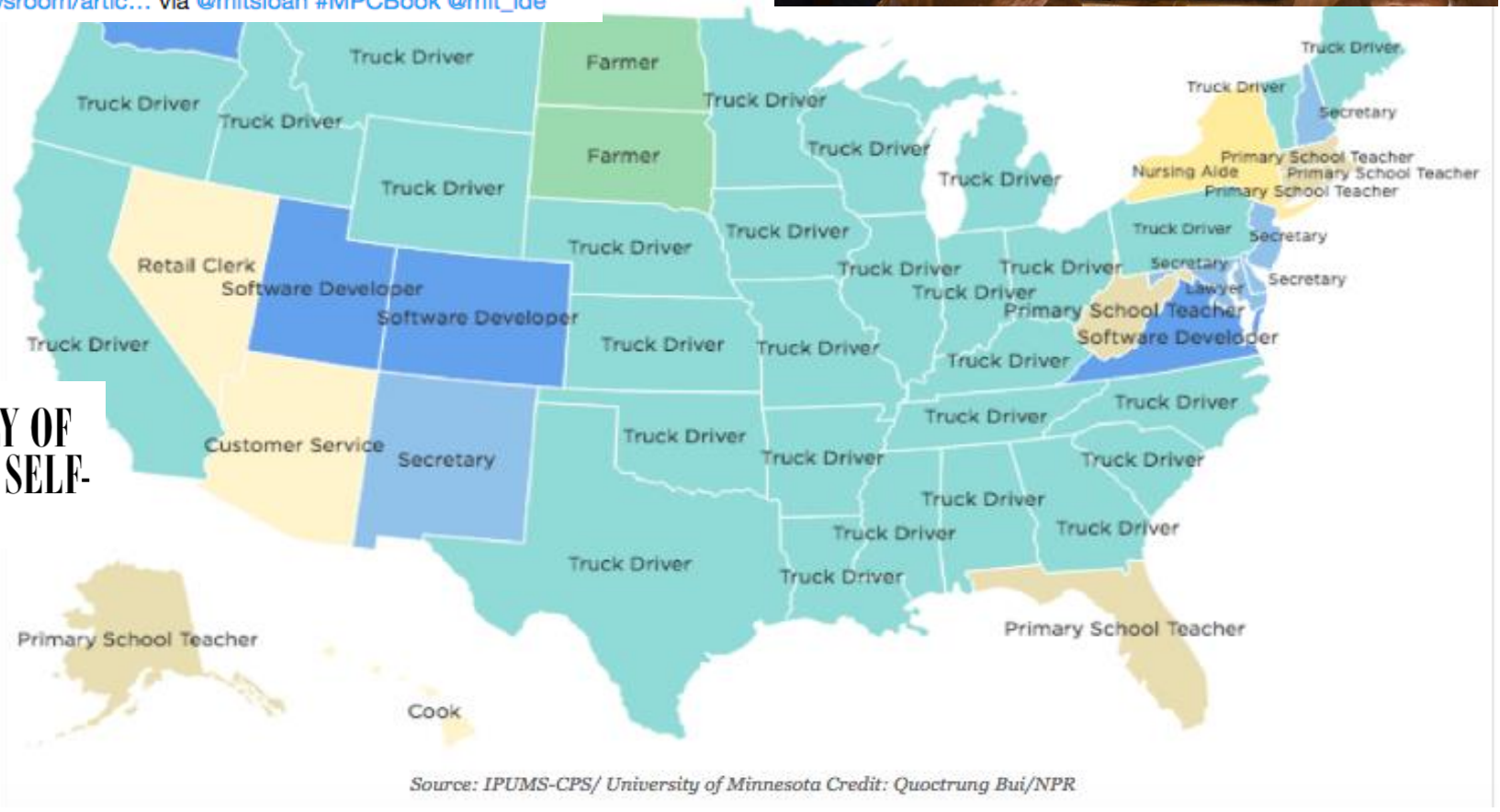
Erik Brynjolfsson @erikbryn · 12h

My conversation with Danny Kahneman: Should algorithms be in the driver's seat? mitsloan.mit.edu/newsroom/artic... via @mitsloan #MPCBook @mit_ide



Source: IPUMS-CPS/ University of Minnesota Credit: Quoctrung Bui/NPR

ALEX DAVIES TRANSPORTATION 05.24.18 04:23 PM

THE UNAVOIDABLE FOLLY OF MAKING HUMANS TRAIN SELF-DRIVING CARS

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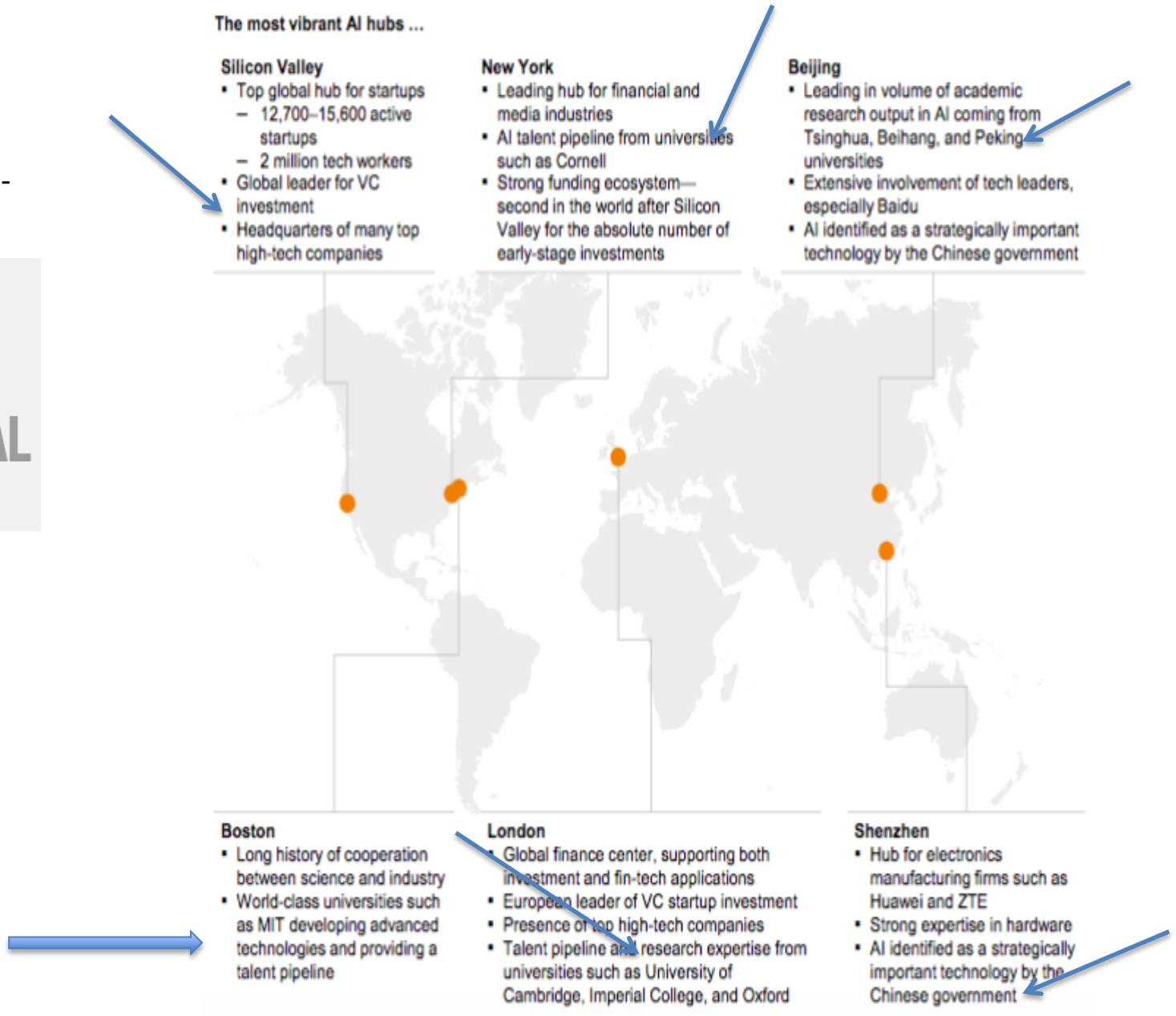
Partnerships – an old trend

Source: McKinsey, 2018,non-academic

MCKINSEY GLOBAL INSTITUTE

ARTIFICIAL INTELLIGENCE
THE NEXT DIGITAL FRONTIER?



From basic science to PRODUCTS and deployed technologies

Artificial intelligence, machine learning, and other analytics techniques that we examined for this research

Techniques

Considered AI for our research

Likelihood to be used in AI applications

Less

More

Advanced techniques

Transfer learning

Reinforcement learning

Deep learning neural networks (e.g., feed forward neural networks, CNNs, RNNs, GANs)

Dimensionality reduction (e.g., PCA, tSNE)

Ensemble learning (e.g., random forest, gradient boosting)

Instance based (e.g., KNN)

Decision tree learning

Monte Carlo methods

Linear classifiers (e.g., Fisher's linear discriminant, SVM)

Clustering (e.g., k-means, tree based, db scan)

Statistical inference (e.g., Bayesian inference, ANOVA)

Markov process (e.g., Markov chain)

Regression Analysis (e.g., linear, logistic, lasso)

Descriptive statistics (e.g., confidence interval)

Naive Bayes classifier

Traditional techniques

SOURCE: McKinsey Global Institute analysis

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University of Toronto
Professor Geoffrey Hinton

Reality check: Gartner 2018

Trend No. 1: AI Foundation

Today's AI Is Narrow AI

Trend No. 2: Intelligent Apps and Analytics

Augmented Analytics Will Enable Users to Spend More Time Acting on Insights

Trend No. 3: Intelligent Things

Swarms of Intelligent Things Will Work Together

Trend No. 4: Digital Twins

Digital Twins Will Be Linked to Other Digital Entities

Trend No. 5: Cloud to the Edge

Edge Computing Brings Distributed Computing Into the Cloud Style

Trend No. 6: Conversational Platforms

Integration With Third-Party Services Will Further Increase Usefulness

Trend No. 7: Immersive Experience

VR and AR Can Help Increase Productivity

Trend No. 8: Blockchain

Blockchain Offers Significant Potential Long-Term Benefits Despite Its Challenges

Trend No. 9: Event-Driven Model

Events Will Become More Important in the Intelligent Digital Mesh

Trend No. 10: Continuous Adaptive Risk and Trust

Barriers Must Come Down Between Security and

Top 10 USA companies by market capitalization, 2018.

Gartner

WHY GARTNER ANALYSTS RESEARCH EVENTS CONSULTING ABOUT

Top 10 Strategic Technology Trends for 2018

2018 [edit]

This list is up to date as of August 3, 2018. Indicated changes in market value are relative to the previous quarter

Rank	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1	Apple Inc. ▼851,317	Apple Inc. ▲909,840[10]	Apple Inc. ▲1,000,000[11]	
2	Alphabet Inc. ▼717,404	Amazon.com ▲824,790[12]		
3	Microsoft ▲702,760[13]	Alphabet Inc. ▲774,840[14]		
4	Amazon.com ▲700,672[12]	Microsoft ▲757,640[13]		
5	Tencent ▲507,990[15]	Facebook ▲562,480[16]		
6	Berkshire Hathaway ▲492,019[17]	Tencent ▼478,580[15]		
7	Alibaba Group ▲470,930[18]	Alibaba Group ▲476,040[18]		
8	Facebook ▼464,189[16]	Berkshire Hathaway ▼463,980[17]		
9	JPMorgan Chase ▲377,410[19]	JPMorgan Chase ▼354,780[19]		
10	Johnson & Johnson ▼343,780[20]	ExxonMobil ▲350,270 [21]		

The Cognitive Revolution

- Yuval Noah Harari: ***Sapiens: A Brief History of Human Kind***. Vintage, London 2014.

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The Cognitive Revolution – a timeline

- **13.5 billion** years ago: matter/energy appears; atoms, molecules.
- 4.5 billion y.a.: Earth is formed
- 3.8 billion: Organisms
- 6 **million:** last common ancestor man/chimpanzee
- **2.5 million:** genus homo – Africa
- 2 million: humans go to Eurasia/evolution of different human species
- 500k: Neanderthals evolve in Middle East/Europe
- 300k: fire
- 200k: *Homo sapiens* evolve in Africa
- **70k: Cognitive revolution: fictive language; Homo sapiens spread out of Africa**
- 45k: Homo sapiens in Australia: extinction of local megafauna
- 30k: Neanderthals extinct.
- 16k: Homo sapiens in America: extinction of local megafauna
- 13k: sapiens rule the world
- 10k: Agriculture; **domestication**; permanent settlements
- 5k: first kingdoms, script, money; polytheism.
- 2.5k: coinage (money); Persians; Buddhism.
- 2k: Christianity; Roman Empire; Han empire in China.
- **500: SCIENTIFIC REVOLUTION**
- 200: Industrial Revolution

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Sir Francis Bacon (1561-1626) /Elizabeth (1533-1603)

“Knowledge is power”, 1597.

- Architect of the Scientific Revolution
- QC, Elizabeth I; “Lord Chancellor”, James I.
- **Scientific method;** empiricism.
- Science as an innovation activity to improve life.
- Helped to unveil human ignorance.
- Legal system influenced *Le* ***Code Napoléon*** *(Code civil des français)****; innovations: freedom and merit****.*

Bacon's cipher *or the* ***Baconian cipher*** *is a method of steganography (a method of hiding a secret message as opposed to just a cipher) devised by Francis Bacon in 1605.* https://en.wikipedia.org/wiki/Bacon%27s_cipher

Innovation is Power

“I believe that this nation should commit itself to achieving the goal, ***before this decade is out****,* ***of landing a man on the Moon*** *and returning him safely to the Earth.*

No single space project in this period will be more impressive to mankind, or more important for the long-range exploration of space; and ***none will be so difficult or expensive to accomplish****.” JFK* ***25 May 1961.***

- *“That’s one small step for [a] man, one giant leap for mankind”* Neil Armstrong, ***20 Jul 1969.***

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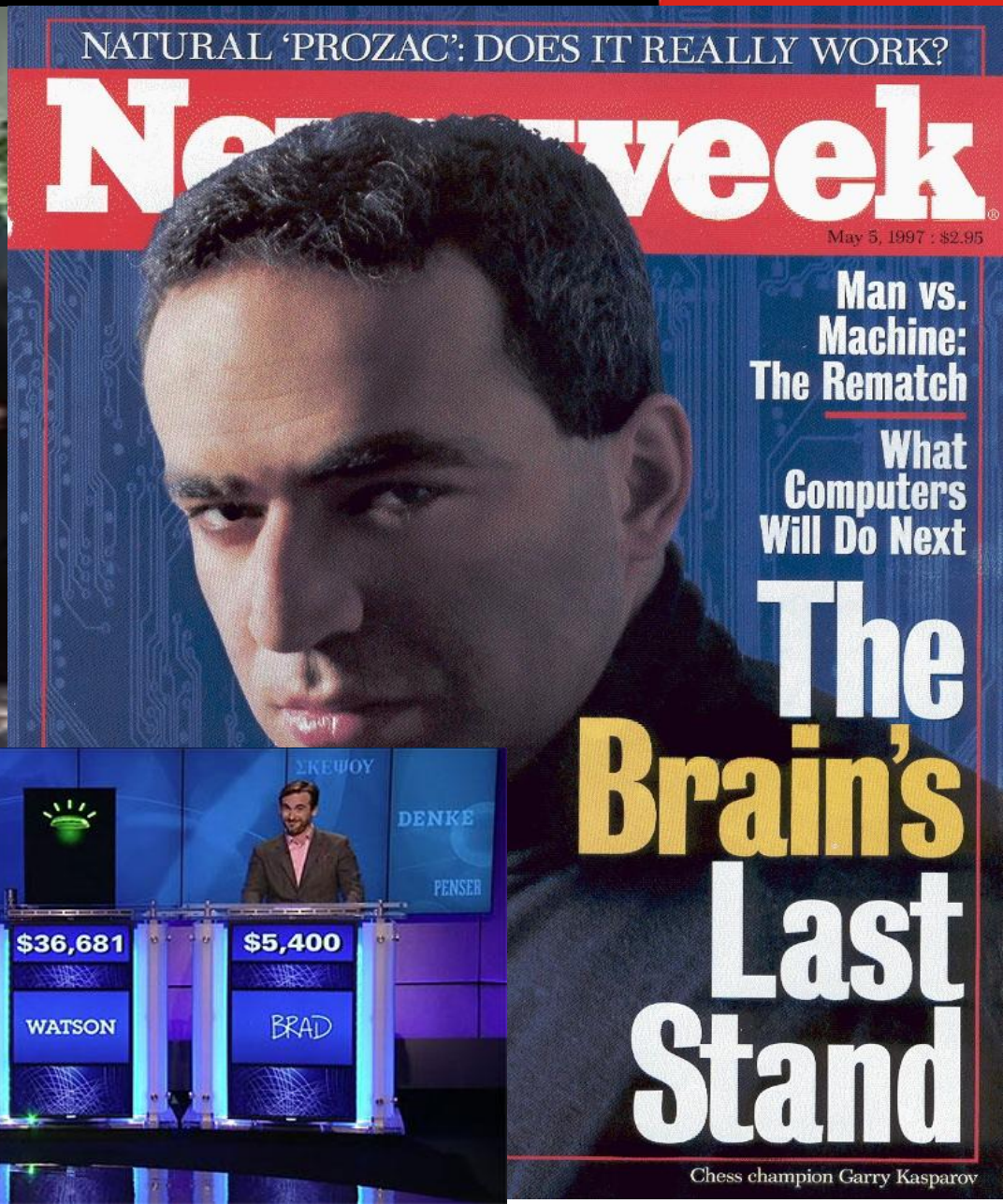
Cognition is Power



Technology Review, MIT 2012!!

Egg Stem Cells

A recent discovery could increase older women's chances of having babies.

Ultra-Efficient Solar

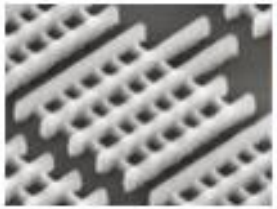
Under the right circumstances, solar cells from Semprius could produce power more cheaply than fossil fuels.

Light-Field Photography

Lytro reinvented the camera so that it can evolve faster.

Solar Microgrids

Village-scale DC grids provide power for lighting and cell phones.



3-D Transistors

Intel creates faster and more energy-efficient processors.

A Faster Fourier Transform

A mathematical upgrade promises a speedier digital world.

Nanopore Sequencing

Simple and direct analysis of DNA will make genetic testing routine in more situations.

Crowdfunding

Kickstarter is funding the commercialization of new technologies.

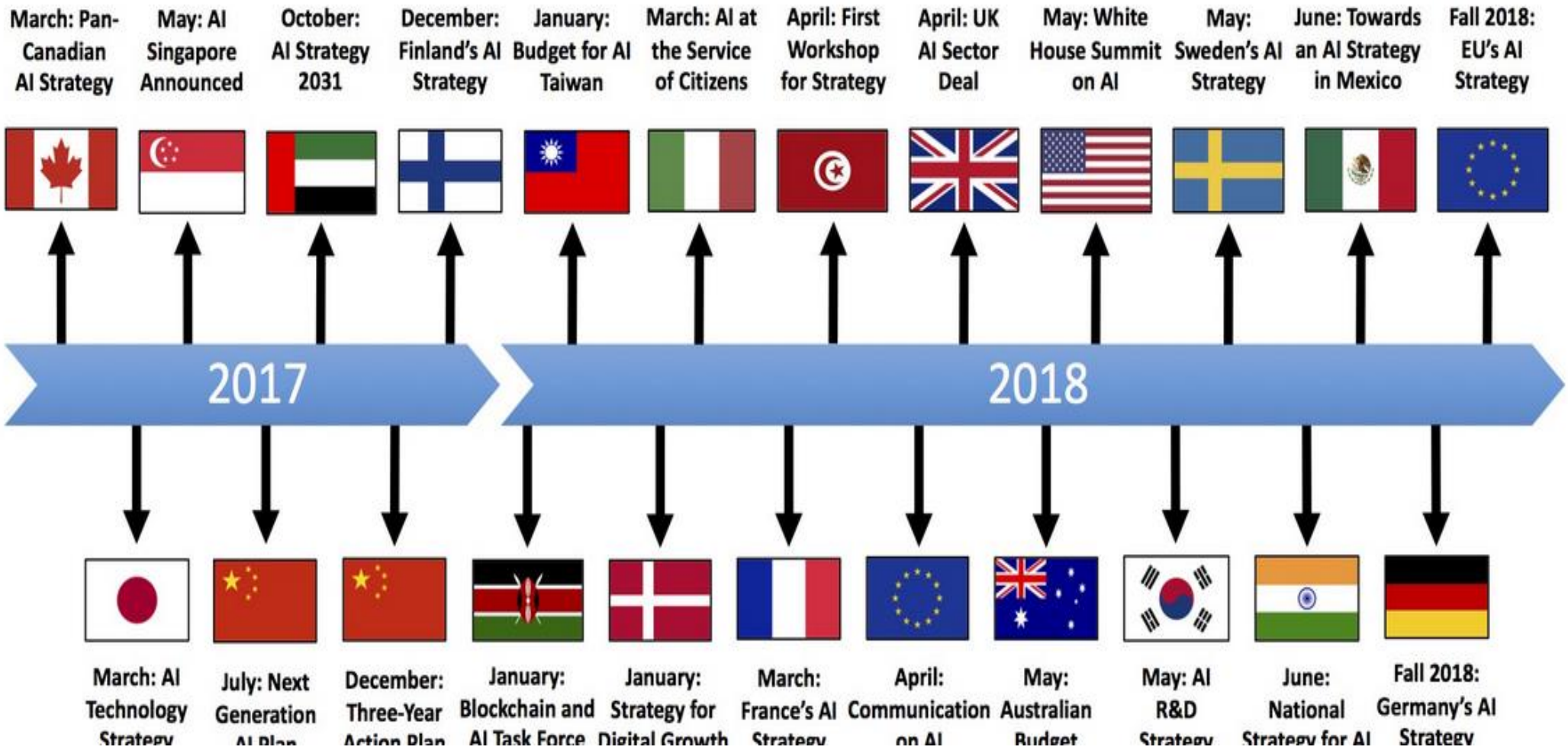
High-Speed Materials Discovery

A new way to identify battery materials suitable for mass production could revolutionize energy storage.

Facebook's Timeline

The social-networking company is collecting and analyzing consumer data on an unprecedented scale.

Estratégias nacionais de I.A.



National AI strategies, 2018

Tim Dutton Follow

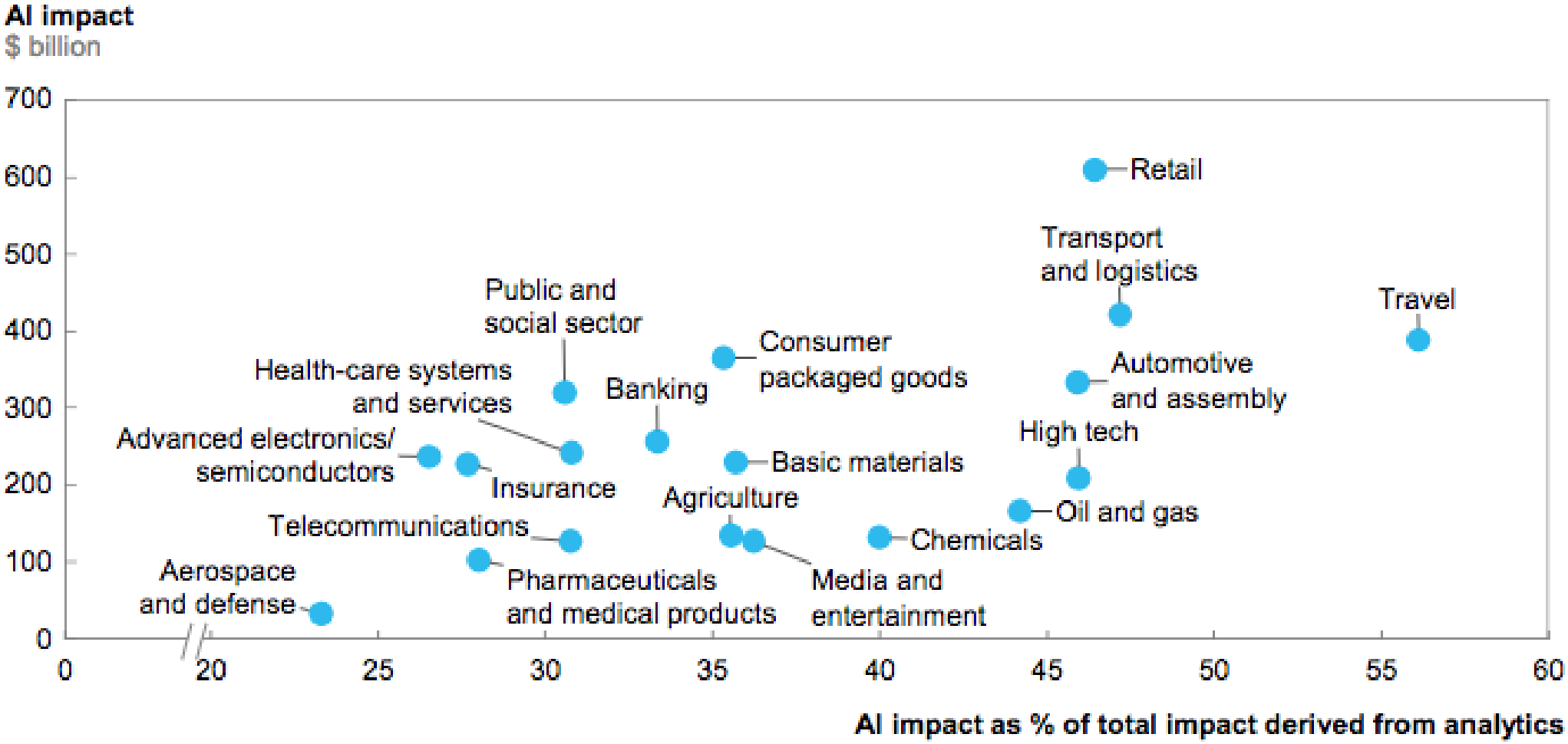
AI Policy Researcher | Founder and Editor-in-Chief of Politics + AI

Jun 28 · 25 min read

AI – riscos e usos

McKinsey Report, Notes from the AI Frontier, April 2018

AI has the potential to create annual value across sectors totaling $3.5 trillion to $5.8 trillion, or 40 percent of the overall potential impact from all analytics techniques



AI – riscos e usos

The Malicious Use of Artificial Intelligence: Forecasting, Prevention, and Mitigation

Feb. 2018

Miles Brundage[1] Shahar Avin[2] Jack Clark[3] Helen Toner[4] Peter Eckersley[5]
Ben Garfinkel[6] Allan Dafoe[7] Paul Scharre[8] Thomas Zeitzoff[9] Bobby Filar[10]
Hyrum Anderson[11] Heather Roff[12] Gregory C. Allen[13] Jacob Steinhardt[14]
Carrick Flynn[15] Seán Ó hÉigeartaigh[16] Simon Beard[17] Haydn Belfield[18]
Sebastian Farquhar[19] Clare Lyle[20] Rebecca Crootof[21] Owain Evans[22]
Michael Page[23] Joanna Bryson [24] Roman Yampolskiy[25] Dario Amodei[26]

Future of Humanity Institute | University of Oxford | Centre for the Study of Existential Risk | University of Cambridge | Center for a New American Security | Electronic Frontier Foundation | OpenAI

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I.A.: sustentabilidade e ética

"The Passat had emissions five to 20 times the standard. The Jetta was worse. It was 15-35 times the standard.”
"I'm just a simple engineer from Michigan," says John German

Ethical, moral and legal consequences of the **AI economy**

Driverless cars: Who should die in a crash?

Who should die in a driverless car crash?

A global study suggests people prefer to save young over elderly people.

bbc.co.uk

Luis Lamb @luislamb · Jul 18

Increasingly responsibility in computing professionals. What should CS departments and labs do? @CRAtweets #CRASnowbird @vardi

ethics.
acm.org

ACM Code of Ethics and Professional Conduct

The ACM Code of Ethics arose from the experiences, values and aspirations of computing professionals around the world, and captures the conscience of the profession....

AI: pushing into the realm of human intellect - EU Policy

AI + Machine Learning – ethical implications

The Register®
Biting the hand that feeds IT

Emergent Tech

Boffins bash Google Translate for sexism

Word shifting code shares Silicon Valley male chauvinism

By Thomas Claburn in San Francisco 10 Sep 2018 at 23:49 66 SHARE ▼

Google Translate is used by over 200 million people daily and, according to boffins from Brazil, its AI-powered tongue twisting tends to deliver sexist results.

In a research paper distributed through pre-printer service A
"Assessing Gender Bias in Machine Translation – A Case Study with Google Translate," Marcelo Prates, Pedro Avelar, and Luis Lamb from Brazil's Federal University of Rio Grande do Sul, explore how Google Translate renders gender pronouns in English from sentences written in a dozen different gender-neutral languages.

The researchers took jobs described in US Bureau of Labor Statistics (BLS) data and used them to construct sentences like "She is an engineer" and "He is an engineer" in languages like Chinese, Hungarian, Japanese and Turkish that use non-gendered pronouns.

They then ran the sentences through Google Translate, via API, to see how Google's language model assigned gendered pronouns in English and subsequently compared the ratio of female and male gendered pronouns to the expected ratio, based on actual gender-based job participation.

Assessing Gender Bias in Machine Translation – A Case Study with Google Translate

Marcelo Prates* MORPRATES@INF.UFRGS.BR
Pedro Avelar* PEDRO.AVELAR@INF.UFRGS.BR
Luis Lamb LAMB@INF.UFRGS.BR
Federal University of Rio Grande do Sul

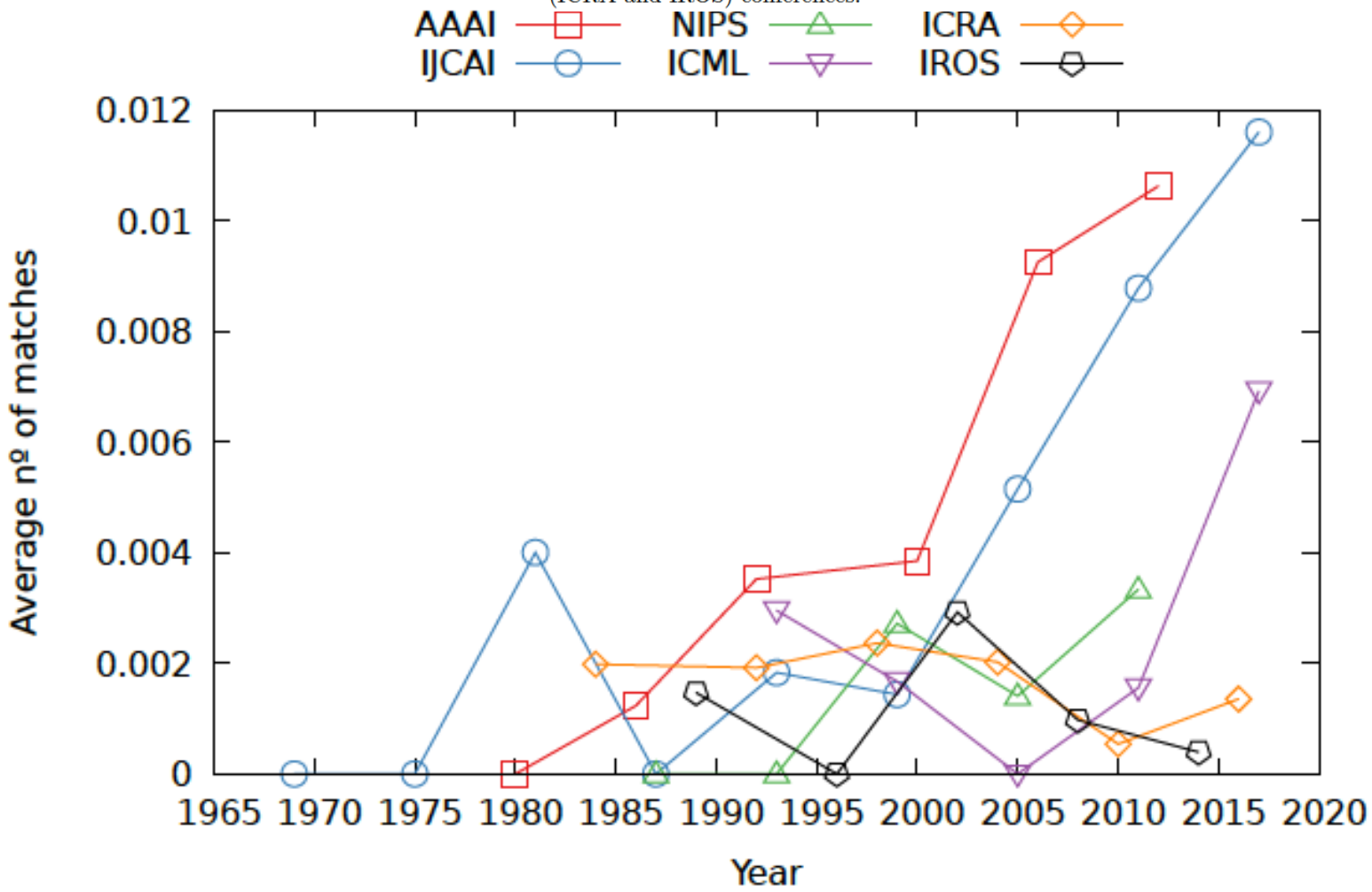
EPiC Series in Computing
Volume 55, 2018, Pages 188–201
GCAI-2018. 4th Global Conference on Artificial Intelligence

On Quantifying and Understanding the Role of Ethics in AI Research: A Historical Account of Flagship Conferences and Journals

Marcelo Prates, Pedro Avelar, and Luis C. Lamb

Conferences					
AAAI	IJCAI	NIPS	ICML	ICRA	IROS
7,179	7,723	6,509	3,568	19,368	15,005
Journals					
ACM Trans.	Comm. ACM	IEEE. Computer	JAIR	IEEE Trans. AI	Artif. Intell.
18,199	11,394	6,694	972	10,731	2,766

Figure 1: Frequency of the selected ethics-related keywords (see Sec. 4 for the list) per five year interval in paper titles for five of the leading AI (AAAI, IJCAI, NIPS and ICML) and Robotics (ICRA and IROS) conferences.



IA e a percepção da população mundial

- Deep learning + AI have recently impacted **people's perception** of Computer Science.

(0) 1997: Deepblue beats chess world champion Kasparov.
(1) 2011: *Watson* wins Jeopardy!
(2) 2012: ImageNet Classification, by Hinton et al - groundbreaking result from deep learning in image recognition.
(3) 2016: Google DeepMind's AlphaGo beats Lee Sedol at the ancient Chinese game of Go.
(4) 2017: Poker playing Texas Hold'Em at human level ability: CMU's Libratus + U of Alberta's DeepStack
(5) December 5, 2017: DeepMind team released **AlphaZero**, which, within 24 hours, achieved a superhuman level of play of Go, chess and shogi.

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Desafio: Explicar e interpretar I.A.

(1) 2012: ImageNet Classification, by Hinton et al - groundbreaking result from deep learning in image recognition.

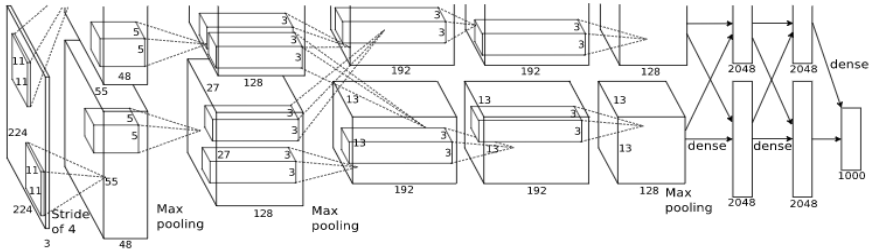
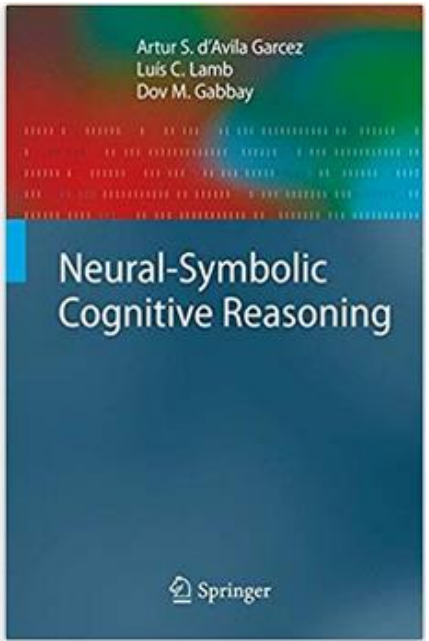


Figure 2: An illustration of the architecture of our CNN, explicitly showing the delineation of responsibilities between the two GPUs. One GPU runs the layer-parts at the top of the figure while the other runs the layer-parts at the bottom. The GPUs communicate only at certain layers. The network's input is 150,528-dimensional, and the number of neurons in the network's remaining layers is given by 253,440–186,624–64,896–64,896–43,264–4096–4096–1000.

Imagenet classification with deep convolutional neural networks. A. Krizhevsky, I. Sutskever, GE Hinton, **NIPS 2012**.



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The New York Times

Artificial Intelligence Hits the Barrier of Meaning

Machine learning algorithms don't yet understand things the way humans do — with sometimes disastrous consequences.

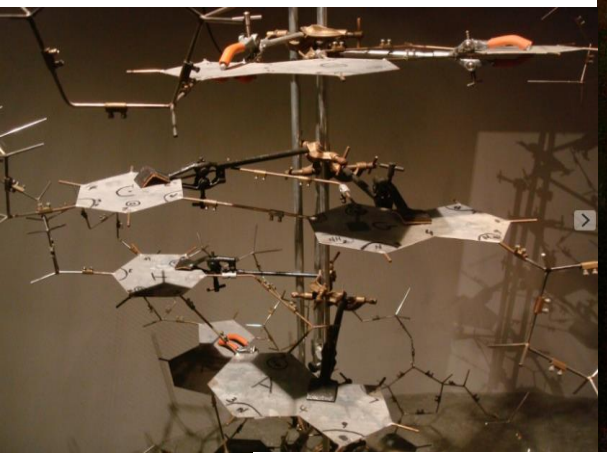
By Melanie Mitchell

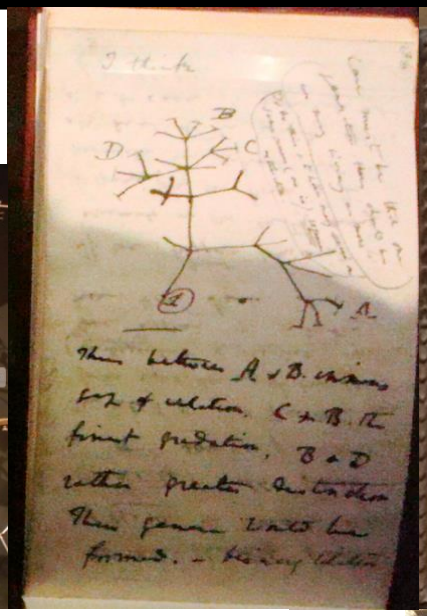
Ms. Mitchell is Professor of Computer Science at Portland State University.

Nov. 5, 2018

True greatness “I think”

Of course, we don’t mean that...





The New York Times

From Jingles to Pop Hits, A.I. Is Music to Some Ears

Scientific American, 2018:

COGNITION

For AI to Get Creative, It Must Learn the Rules—Then How to Break ‘Em

New artificial intelligence systems are using “adversarial networks” to develop creativity and originality by more fluidly mixing and matching real-world information

By Chris Baraniuk on January 25, 2018

True greatness “I think”

The New York Times

A Robot Walks Into a Bar. But Can It Do Comedy?

8 Aug 18: LONDON — One recent evening at a London pub, Piotr Mirowski, 39, stood in front of several dozen comedy fans to prove that an artificially intelligent computer program could perform improvised comedy.

*When someone talks to it **[A.L.Ex]**, the system uses a tool called a neural network**, vaguely modeled on the brain, to analyze similar exchanges in its database and compose its own response***.

Kory Mathewson, left, in Canada, and Piotr Mirowski in London. They have worked together on A.L.Ex, Mr. Mirowski's A.I. improv performer, helping it get better at staying on topic.
Daniel Wood for The New York Times; Tom Jamieson for The New York Times

China's Xinhua agency unveils AI news presenter

By Chris Baraniuk
Technology reporter

8 November 2018

Share

BBC News, 08 Nov. 2018:

Xinhua News claims the presenter "can read texts as naturally as a professional news anchor", though not everyone may agree.

"Hello, you are watching English news programme," says the English-speaking presenter at the start of his first report.

Ciência da Computação, I.A. e poder

Data is power... knowledge is power...

our data is their power...

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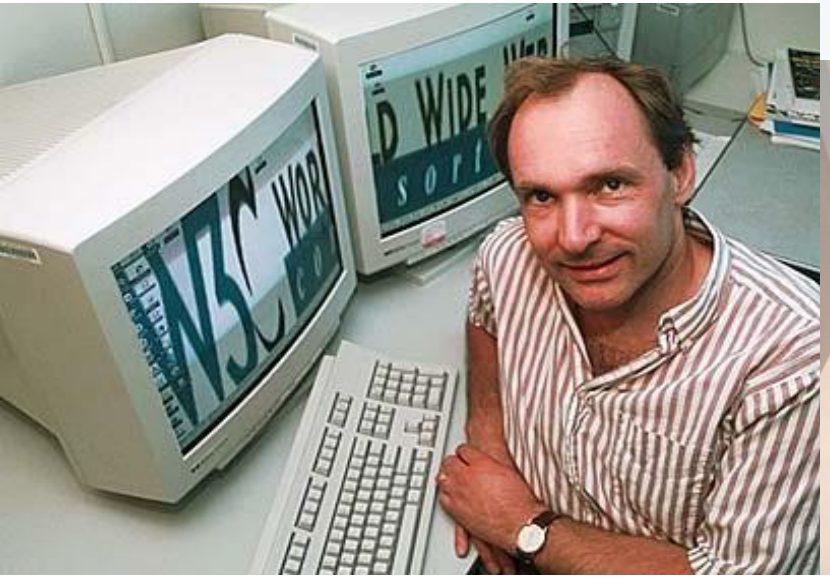
Colaboração

Summary – take home message

1989: “a large hypertext database with typed links”

04/93: CERN made the World Wide Web available on a royalty-free basis.

Are we living *in* a new economic and social revolution?



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Tim Berners-Lee @timberners_lee · 19h

We’re at a 50/50 moment for the web. We’ve created something amazing together, but half the world is still not online, and our online rights and freedoms are at risk. The web has done so much for us, but now we need to stand up #ForTheWeb #WebSummit

26 647 1.1K

Sumário

- Século XXI: século da ciência - Microsoft

- Segunda Guerra Mundial: o trabalho em Bletchley Park **reduziu a guerra em pelo menos dois** anos (Churchill).

"If you want the computer to have general intelligence, the outer structure has to be commonsense knowledge and reasoning", John McCarthy, in Shasha&Lazere, 1995**.**

"We can only see a short distance ahead, but we can see plenty there that needs to be done."
A.M. Turing in *"Computing Machinery and Intelligence"*, Mind,1950.