IMD1101
Machine Learning

Lesson #01
Course Introduction & Directions

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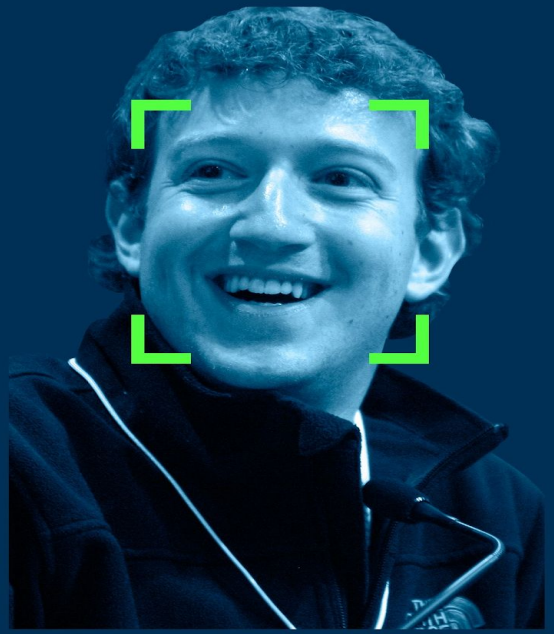
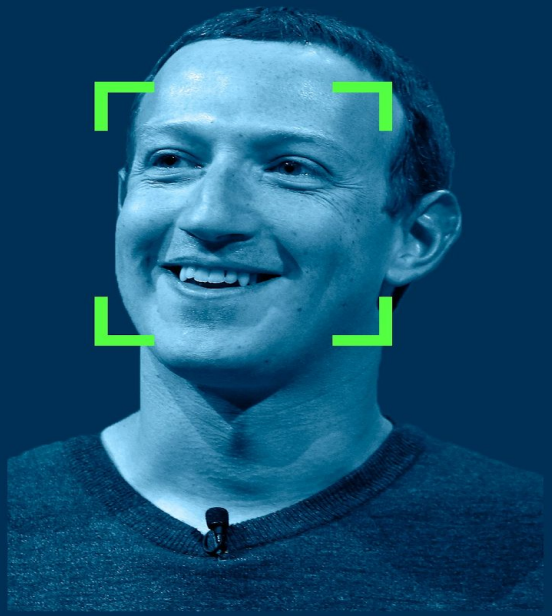
https://github.com/ivanovitchm

Introduction

#10yearschallenge





#10yearschallenge

NOKIA
100%
2009
NOKIA
99%
2019

2009
©2009 - ReD8ull

2019

$0.00

2009

$3,363.36

2019

99
Destino
Partida
POP
99TAXI
Confirmar trajeto
2009
2019

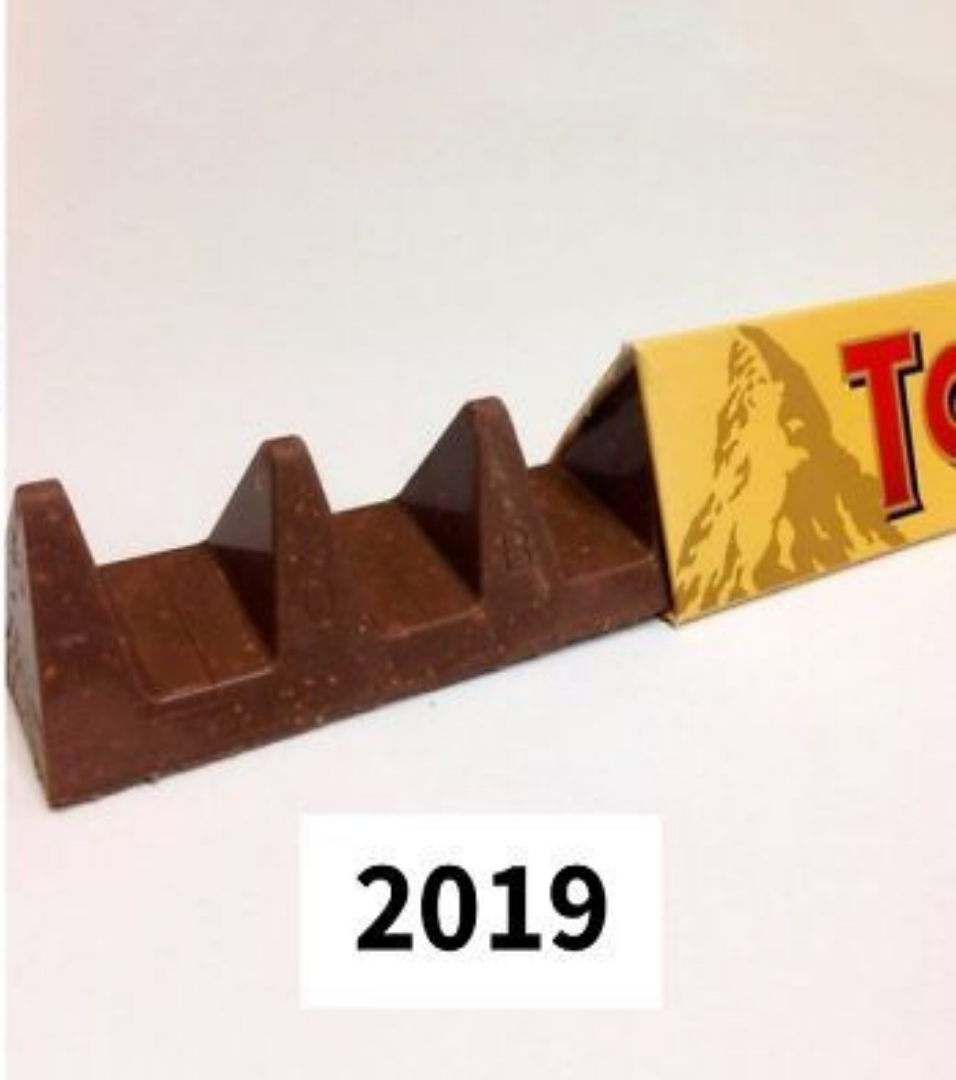
2009
2019
Ligando:
Pizzaria
do Bigod...
ENTREGAR EM
Seu Endereço, 000
Filtros
Pizza do Bigode
Pizzaria Sorriso
Pizza da Nonna
Pizzaria da Cidade

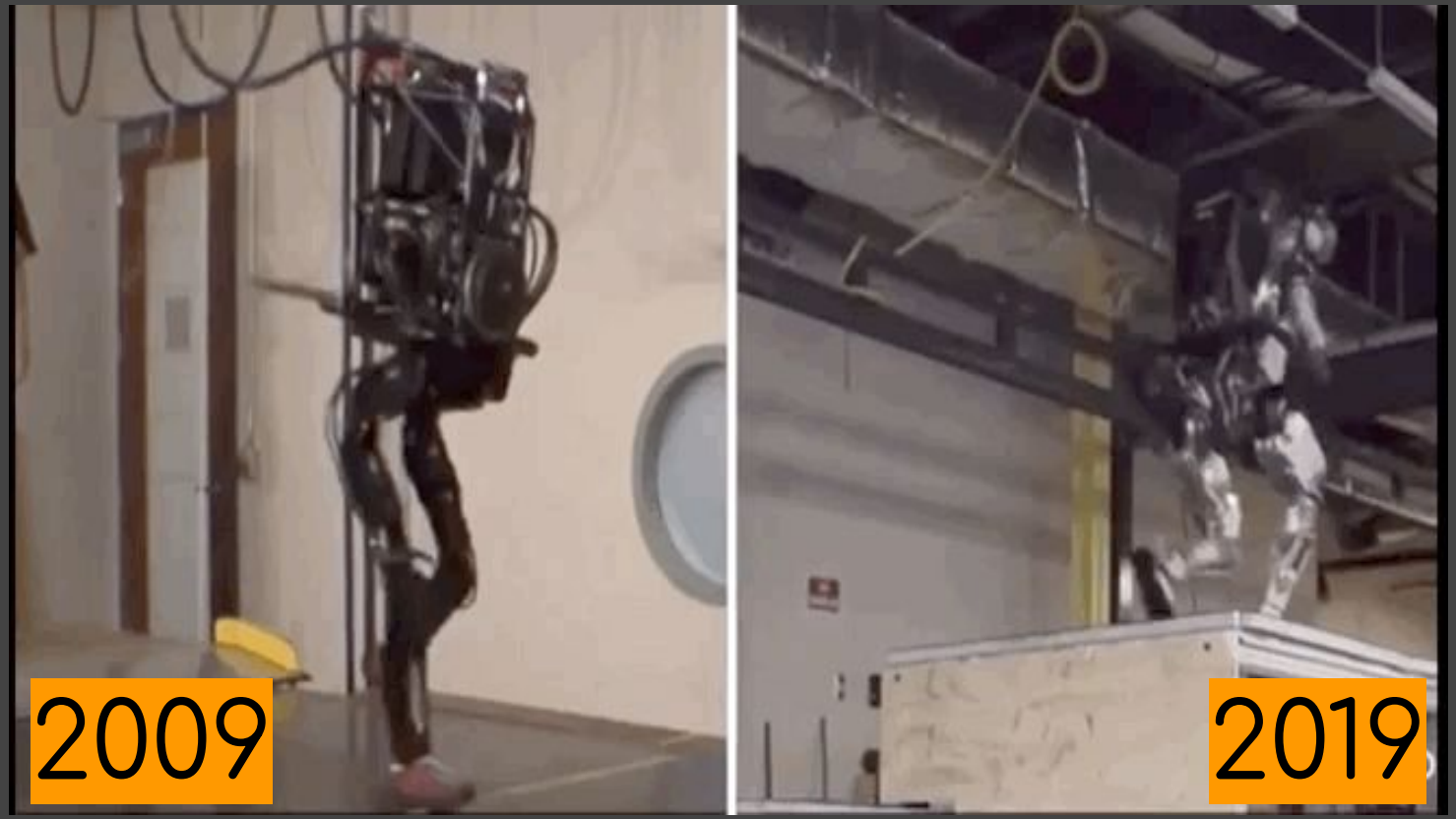
BIG changes

30Mbps
R$ 89,90
2019

125 kbps
R$ 59,90
2009

TOBLER
2009


2019


2009
2019

#2019 MATRIX
http://bit.do/amatrixchegou

12º FÓRUM
INTERNACIONAL
DE TI BANRISUL
plugin

Since Jan. 2019

GERMANY CLOSES LAST COAL MINE

BIGGEST WIND FARM IN THE WORLD OPENS IN ARGENTINA

THE FIRST EARTH ARTIFICIAL INTELLIGENCE COLONY

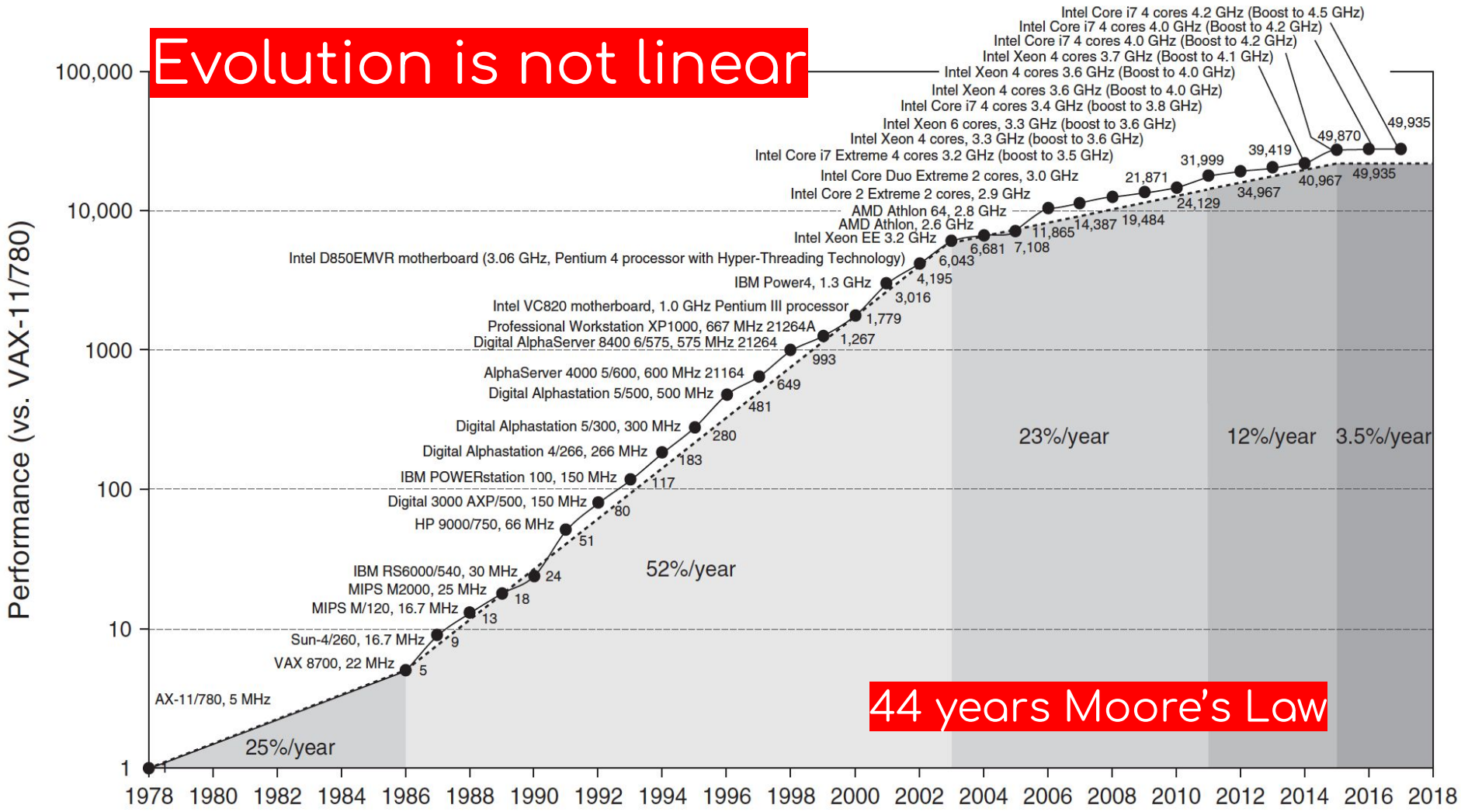
BROUGHT COTTON AND SUGAR CANE IN THE DARK SIDE OF THE MOON

HEART WITH HUMAN FABRIC IS MADE WITH 3D PRINTER

What do they have in common?

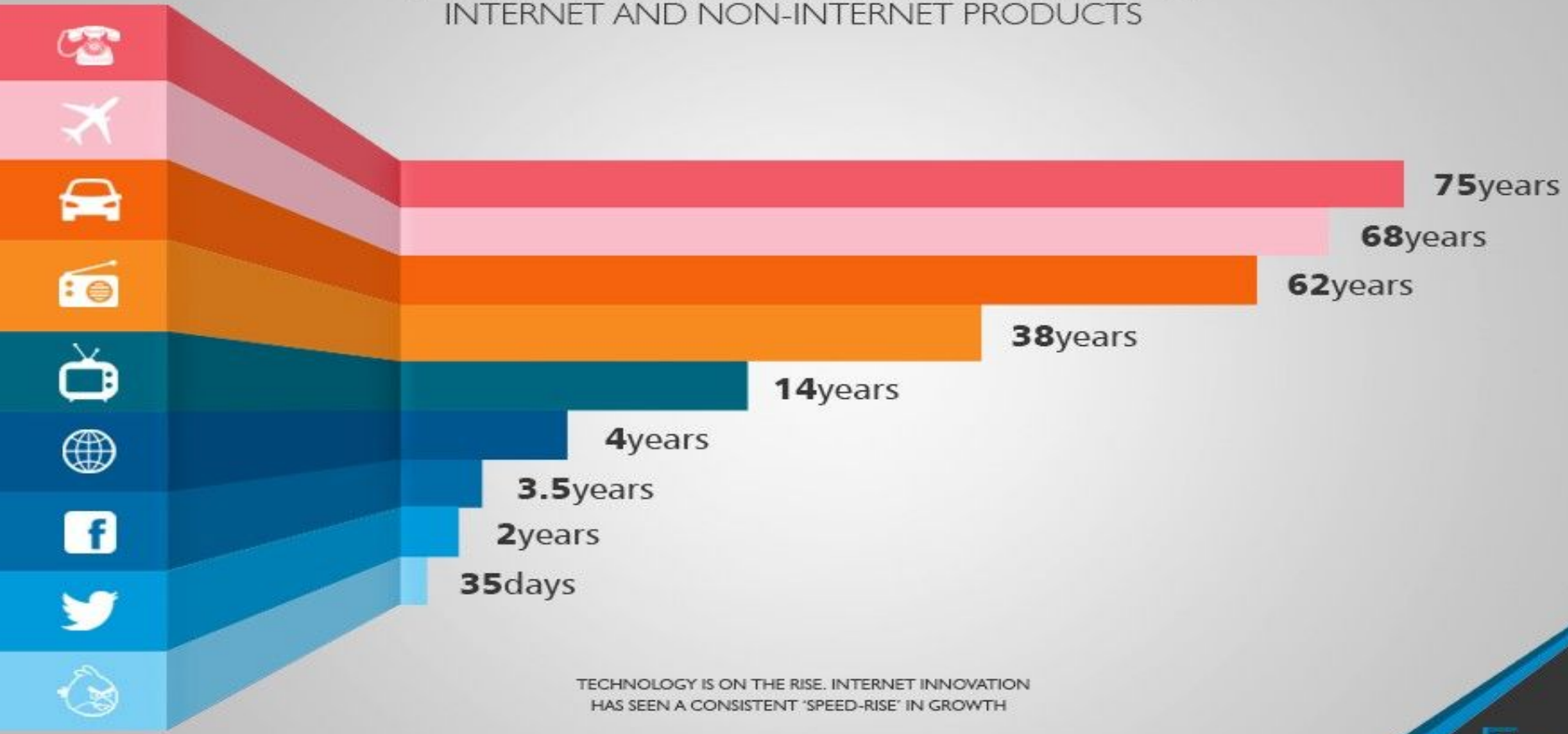
exponential growth of technologies

Evolution is not linear



44 years Moore's Law

REACHING 50 MILLION USERS: THE JOURNEY OF INTERNET AND NON-INTERNET PRODUCTS



TECHNOLOGY IS ON THE RISE. INTERNET INNOVATION HAS SEEN A CONSISTENT 'SPEED-RISE' IN GROWTH

TECHTODAY

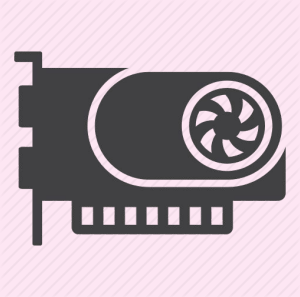
What is the

CONSEQUENCE

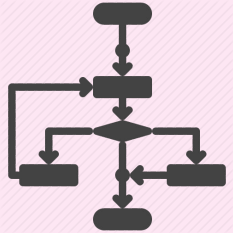
of all that?

DATA

INTERNET



HARDWARE



ALGORITHM

data comes from everywhere

Data Files
(XML, CSV, Excel, JSON, …)

Database
(MySQL, Oracle, …)

API

Sites

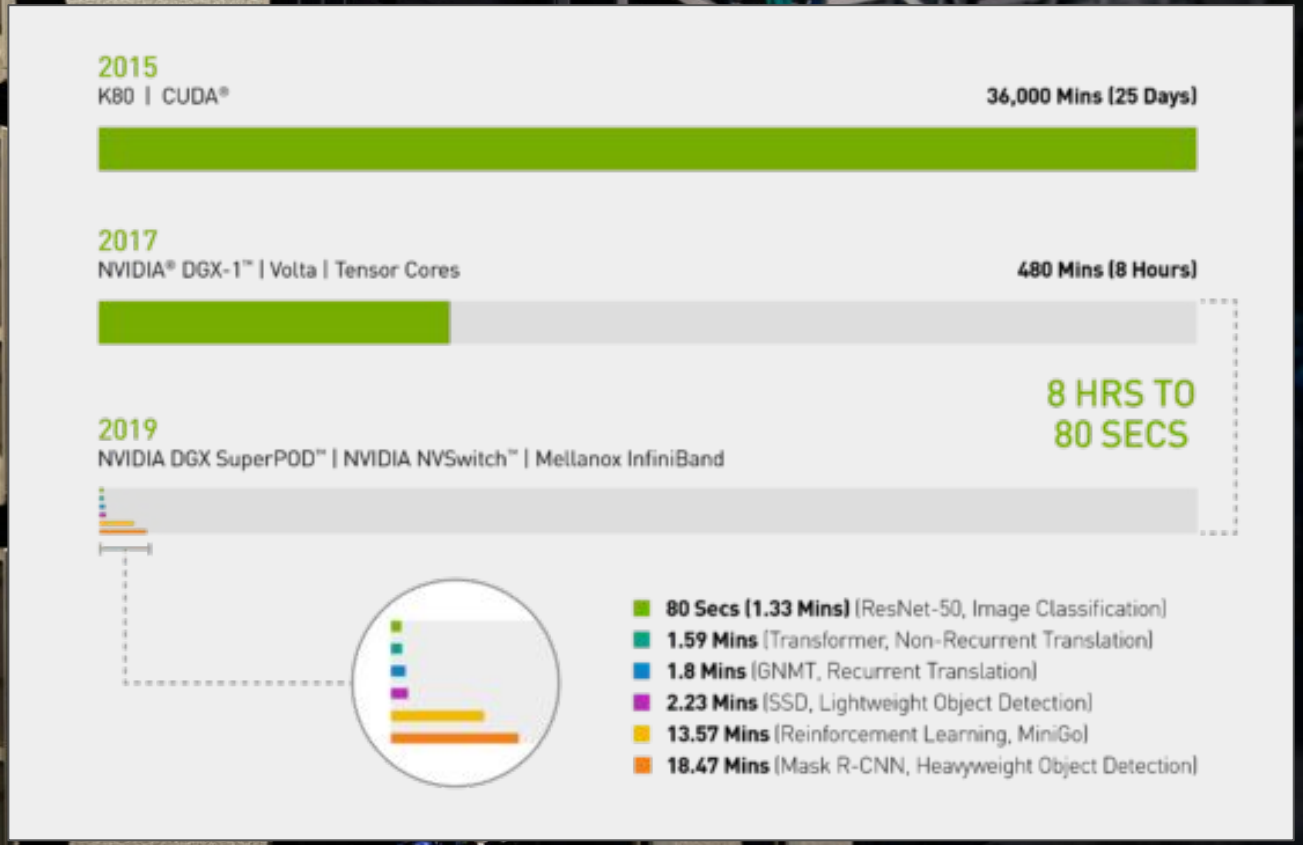
Text and reports

Maps

Image and videos

Social Media

5G



https://www.kaggle.com/keras/resnet50
https://blogs.nvidia.com/blog/2019/07/10/mlperf-ai-performance-records/

ICML 2019 - 3424 initial submissions (22.6% acceptance rate)

International Conference on Machine Learning (ICML)

https://www.microsoft.com/en-us/research/project/academic/articles/icml-conference-analytics/

Publication per year

Google Scholar Blog

2019 Scholar Metrics Released

Friday, July 19, 2019

Scholar Metrics provide an easy way for authors to quickly gauge the visibility and influence of recent articles in scholarly publications. Today, we are releasing the 2019 version of Scholar Metrics. This release covers articles published in 2014–2018 and includes citations from all articles that were indexed in Google Scholar as of July 2019.

Scholar Metrics include journals from websites that follow our inclusion guidelines and selected conferences in Engineering & Computer Science. Publications with fewer than 100 articles in 2014-2018, or publications that received no citations over these years are not included.

https://scholar.googleblog.com/2019/07/2019-scholar-metrics-released.html

ARTIFICIAL INTELLIGENCE

IS NOT NEW

ARTIFICIAL INTELLIGENCE

Any technique which enables computers to mimic human behavior

MACHINE LEARNING

AI techniques that give computers the ability to learn without being explicitly programmed to do so

DEEP LEARNING

A subset of ML which make the computation of multi-layer neural networks feasible

1950's 1960's 1970's 1980's 1990's 2000's 2010s

ORACLE

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Artificial Intelligence

We analyzed 16,625 papers to figure out where AI is headed next

Our study of 25 years of artificial-intelligence research suggests the era of deep learning may come to an end.

by **Karen Hao**

Jan 25, 2019

https://www.technologyreview.com/s/612768/we-analyzed-16625-papers-to-figure-out-where-ai-is-headed-next/

The number of papers we downloaded from the arXiv

All of the papers available in the “artificial intelligence” section through November 18, 2018

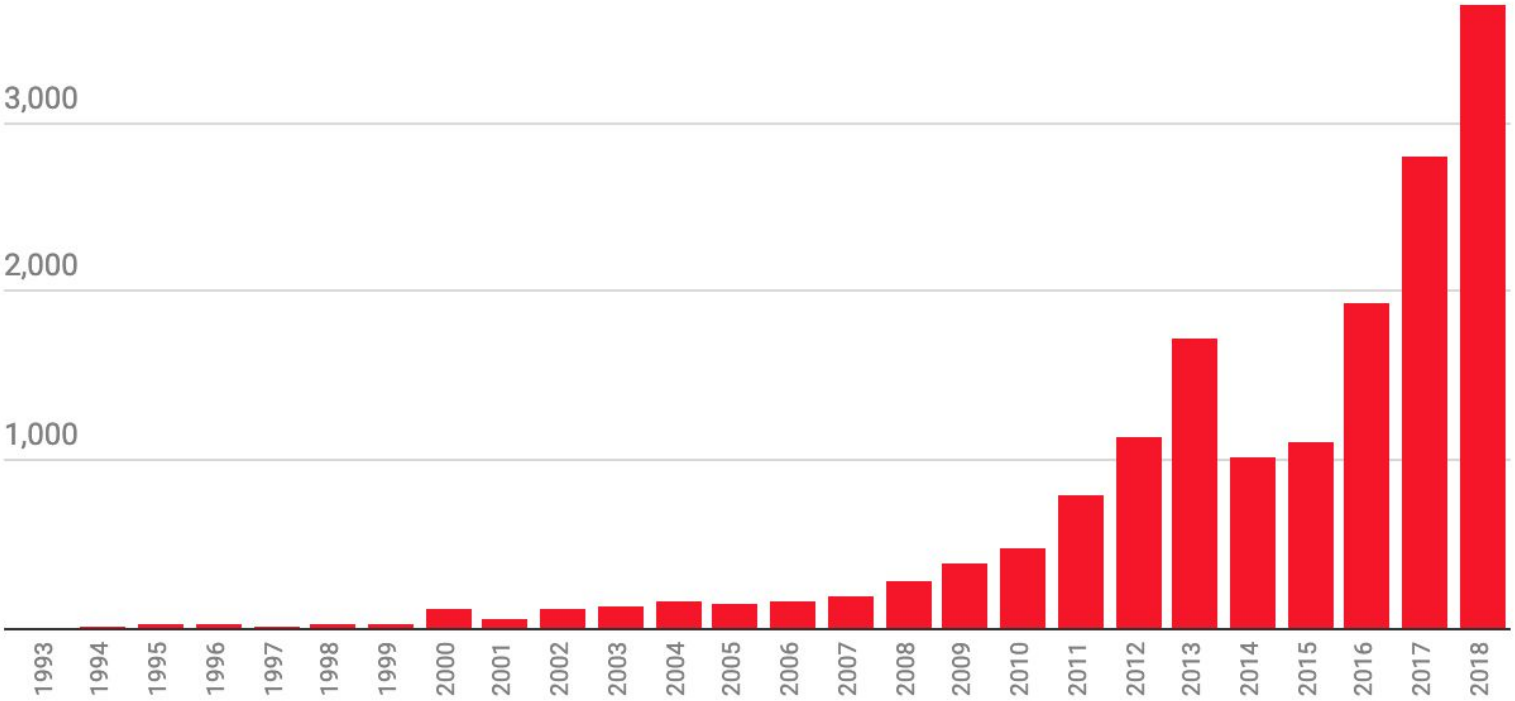
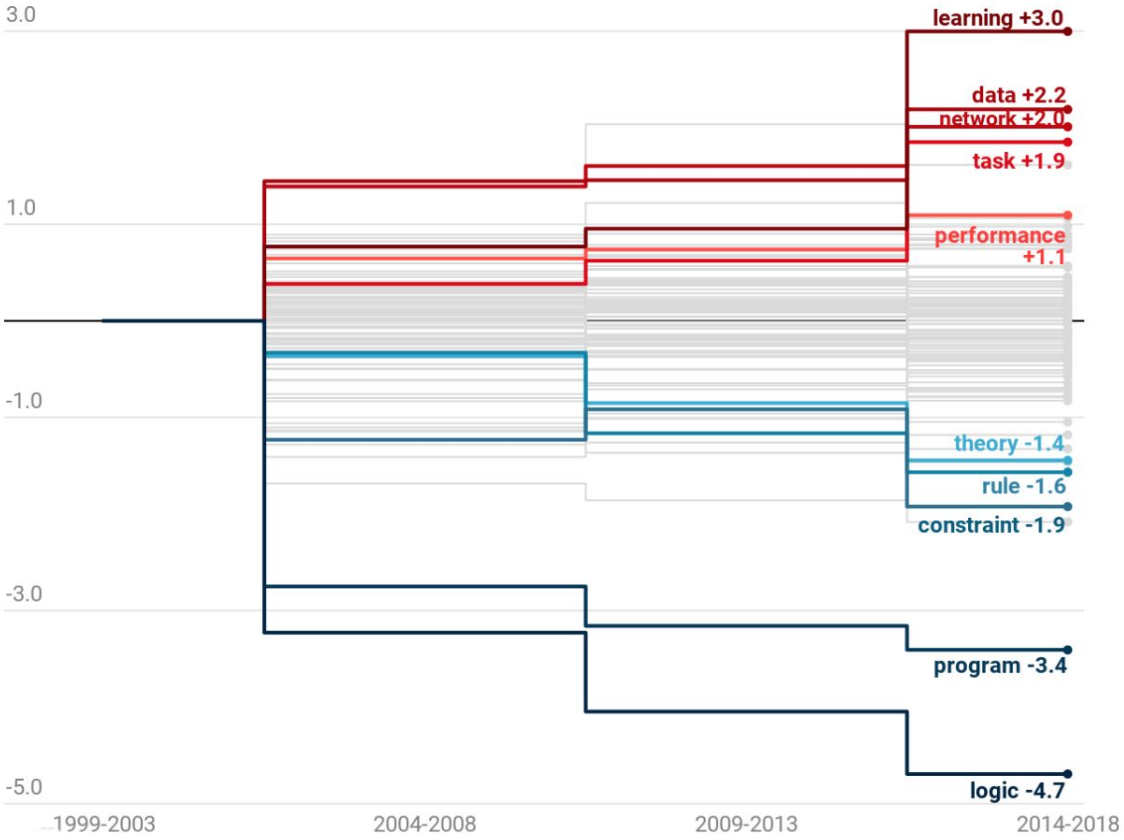


Chart: MIT Technology Review • Source: arXiv.org • Created with Datawrapper

Machine learning eclipses knowledge-based reasoning

Change in mentions per 1,000 words for the top 100 words



Among the top 100 words mentioned, those related to knowledge-based systems—like "logic," "constraint," and "rule"—saw the greatest decline. Those related to machine learning—like "data," "network," and "performance"—saw the highest growth.

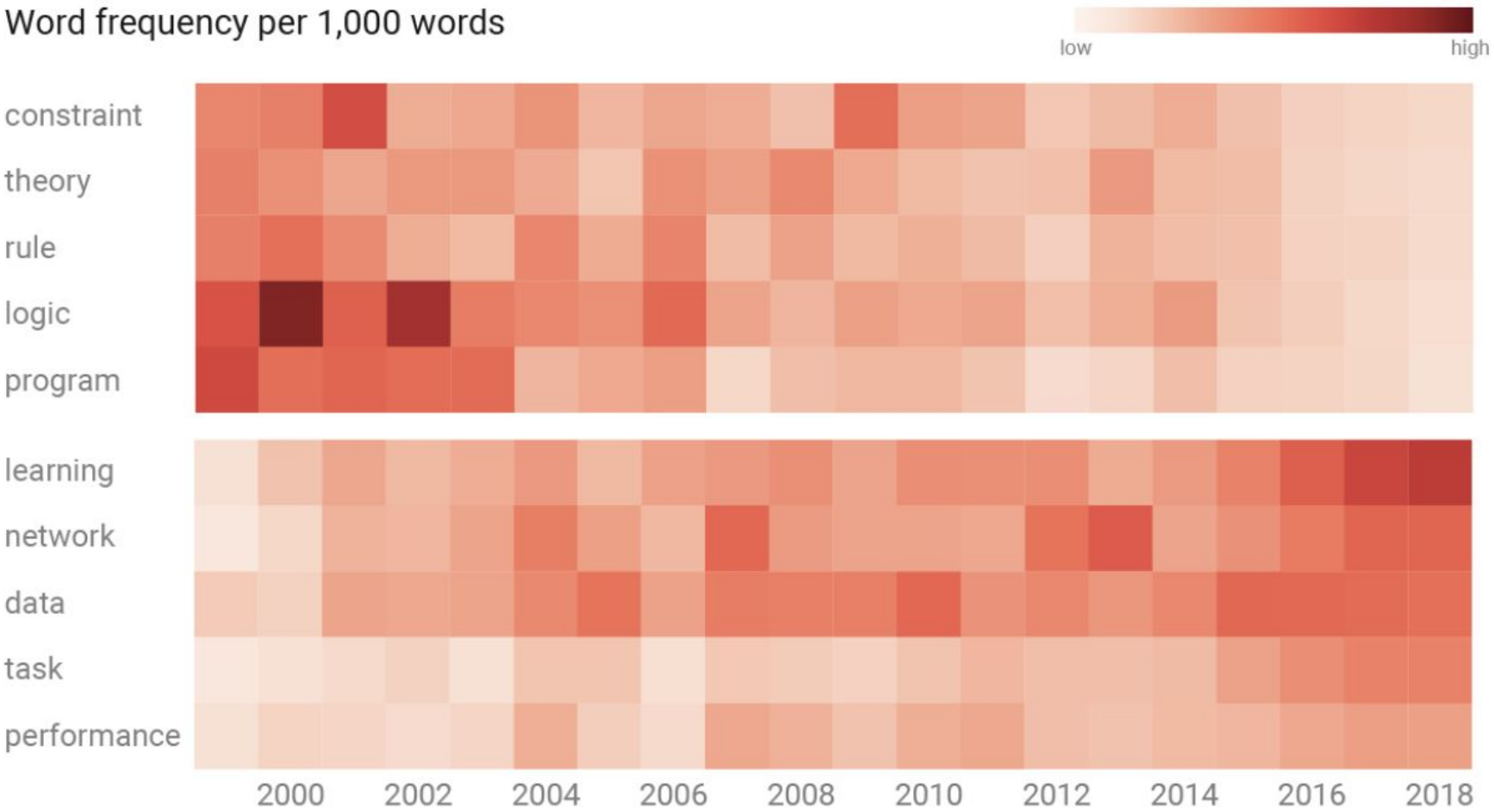
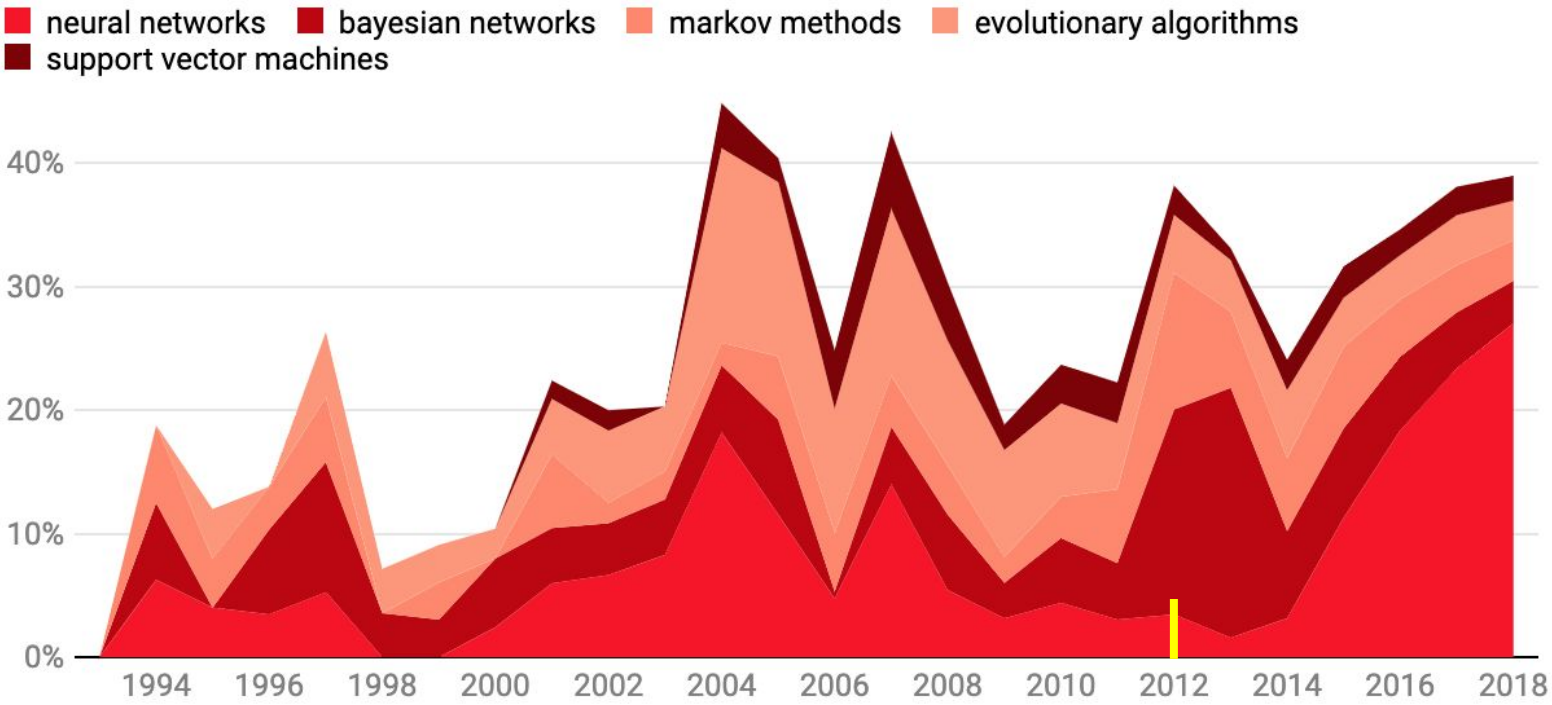


Chart: MIT Technology Review • Source: arXiv.org

Neural networks take over other machine-learning methods

Percentage of papers that mention each method



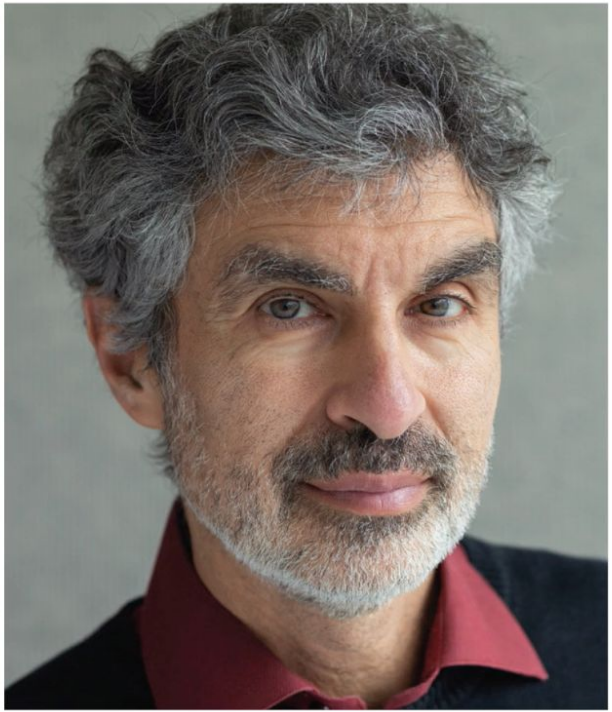
Geoffrey Hinton
Andrew ng

Hover over the chart areas to see their labels.

Chart: MIT Technology Review • Source: arXiv.org • Created with Datawrapper

2018 ACM A.M. TURING AWARD RECIPIENTS

Geoffrey Hinton



Yoshua Bengio

Yann LeCun

http://bit.do/futureai

Geoffrey Hinton and Yann LeCun to Deliver Turing Lecture

Watch later Share

acm FCRC

https://www.youtube.com/watch?v=VsnQf7exv5I

2018 ACM A.M. Turing Lecture

June 23, 2019

5:15pm MST

TURING AWARD SINCE 1966

Geoffrey Hinton

Yann LeCun

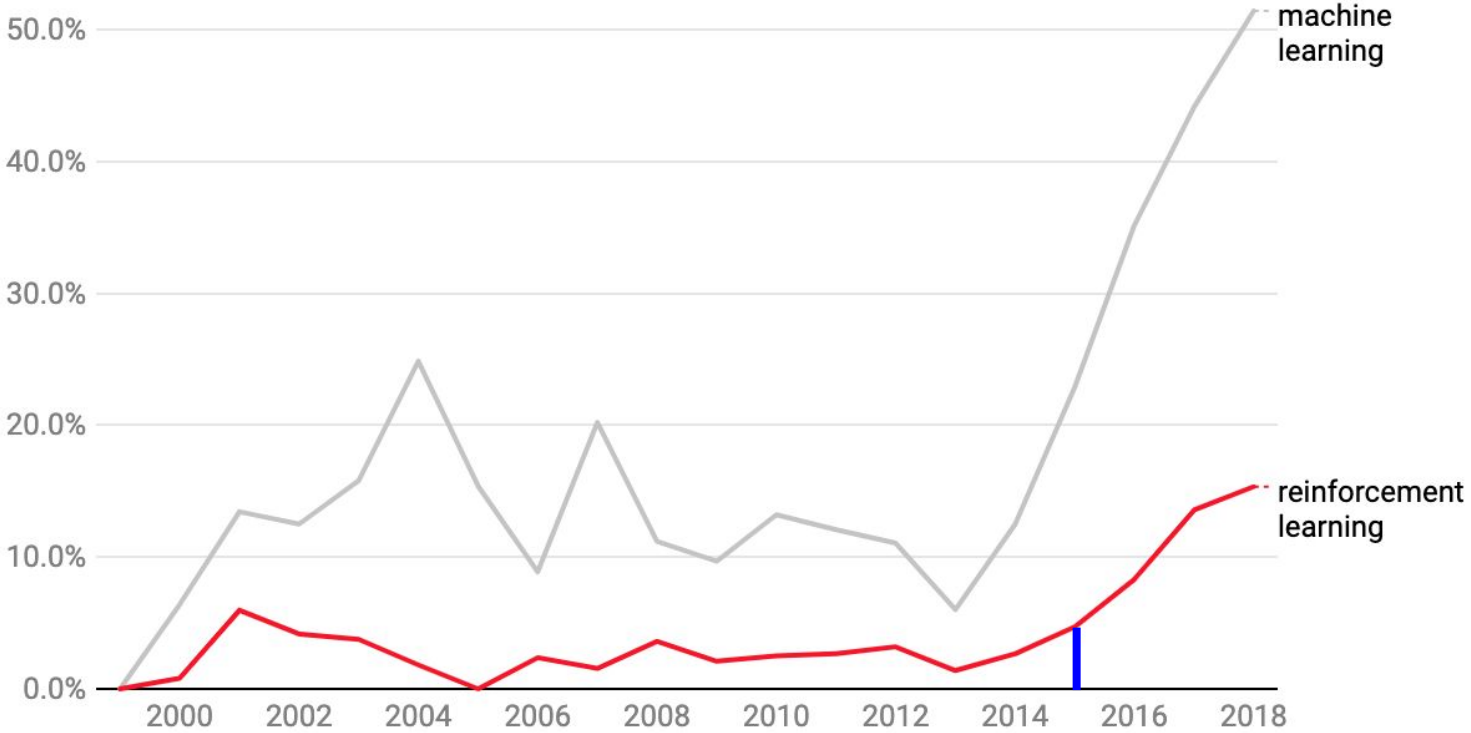
MORE VIDEOS

0:00 / 1:31:50

YouTube

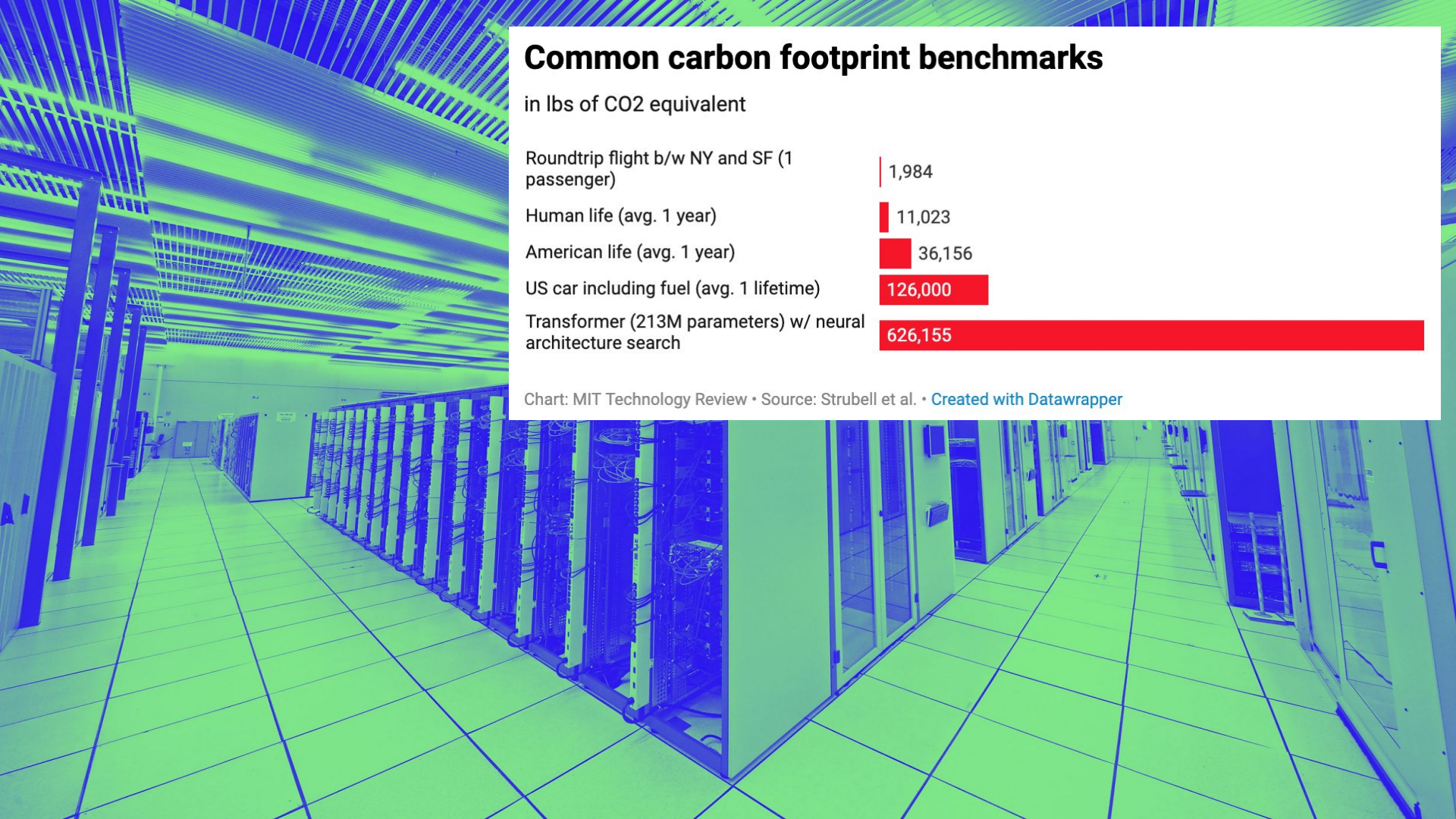
Reinforcement learning is gaining momentum

Share of papers that mention it compared to any type of machine learning



Alpha Go

Chart: MIT Technology Review • Source: arXiv.org • Created with Datawrapper


Common carbon footprint benchmarks
in lbs of CO2 equivalent
Roundtrip flight b/w NY and SF (1 passenger)
1,984
Human life (avg. 1 year)
11,023
American life (avg. 1 year)
36,156
US car including fuel (avg. 1 lifetime)
126,000
Transformer (213M parameters) w/ neural architecture search
626,155
Chart: MIT Technology Review • Source: Strubell et al. • Created with Datawrapper

The estimated costs of training a model

"The privatization of AI research"

	Date of original paper	Energy consumption (kWh)	Carbon footprint (lbs of CO2e)	Cloud compute cost (USD)
Transformer (65M parameters)	Jun, 2017	27	26	$41-$140
Transformer (213M parameters)	Jun, 2017	201	192	$289-$981
ELMo	Feb, 2018	275	262	$433-$1,472
BERT (110M parameters)	Oct, 2018	1,507	1,438	$3,751-$12,571
Transformer (213M parameters) w/ neural architecture search	Jan, 2019	656,347	626,155	$942,973-$3,201,722
GPT-2	Feb, 2019	-	-	$12,902-$43,008

Note: Because of a lack of power draw data on GPT-2's training hardware, the researchers weren't able to calculate its carbon footprint.

Table: MIT Technology Review • Source: Strubell et al. • Created with Datawrapper

image recognition
face recognition
cancer diagnosis
self-driving cars

speech recognition
transcription
voice assistants
voice identification

text prediction
autocorrect
autocomplete

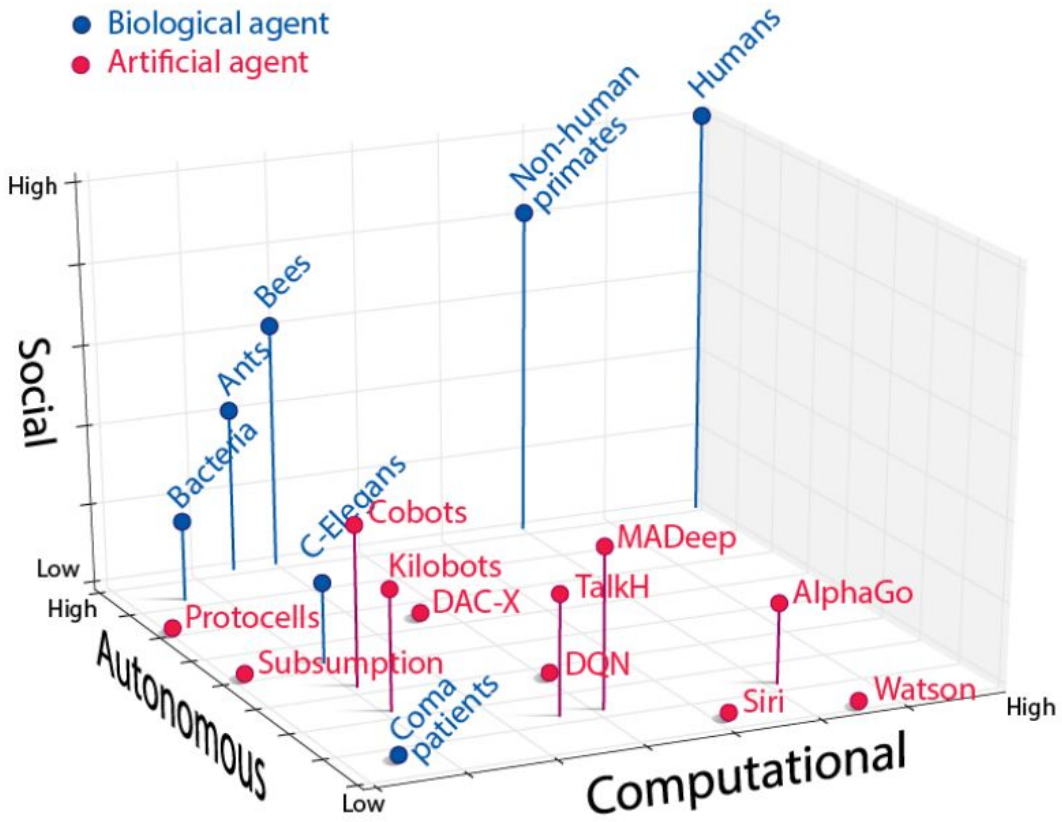
ranking systems
search on Google
newsfeed on Facebook

recommender systems
show recs on Netflix
music recs on Spotify
video recs on Youtube
product recs on Amazon
Target ads

"whatever a human can do, a machine learning model can do better, given time and effort"

temp

https://arxiv.org/abs/1705.11190



AGI is much more than just computing. Autonomy & Socialization are more difficult to design.

DATA VIOLENCE

and how bad engineering choices can damage society

Research | Computer Vision

Does object recognition work for everyone? A new method to assess bias in CV systems

June 07, 2019 Written by Terrance DeVries, Ishan Misra, Changhan Wang, Laurens van der Maaten

Share

https://ai.facebook.com/blog/new-way-to-assess-ai-bias-in-object-recognition-systems/

DOLLAR STREET

In the news people in other cultures seem stranger than they are.
We visited 264 families in 50 countries and collected 30,000 photos.
We sorted the homes by income, from left to right.

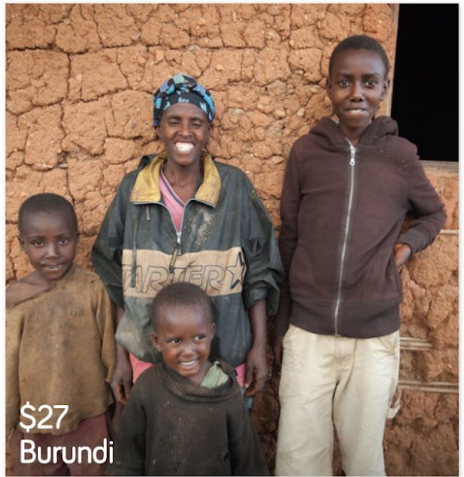
See how people *really* live

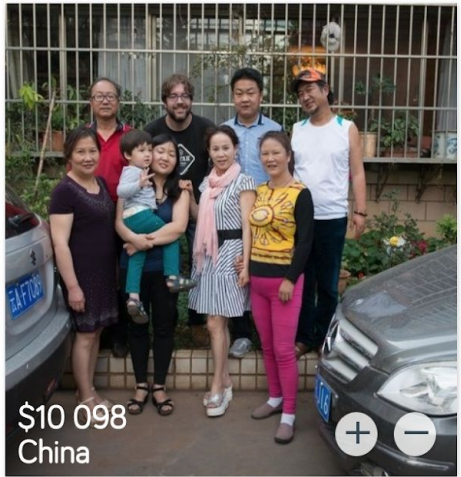
Quick tour | Maybe later

Families in the World by income

English

POOREST — RICHEST





Soap

Country of Origin: Nepal
Prediction: Food

Spices

Country of Origin: Philippines
Prediction: Beer

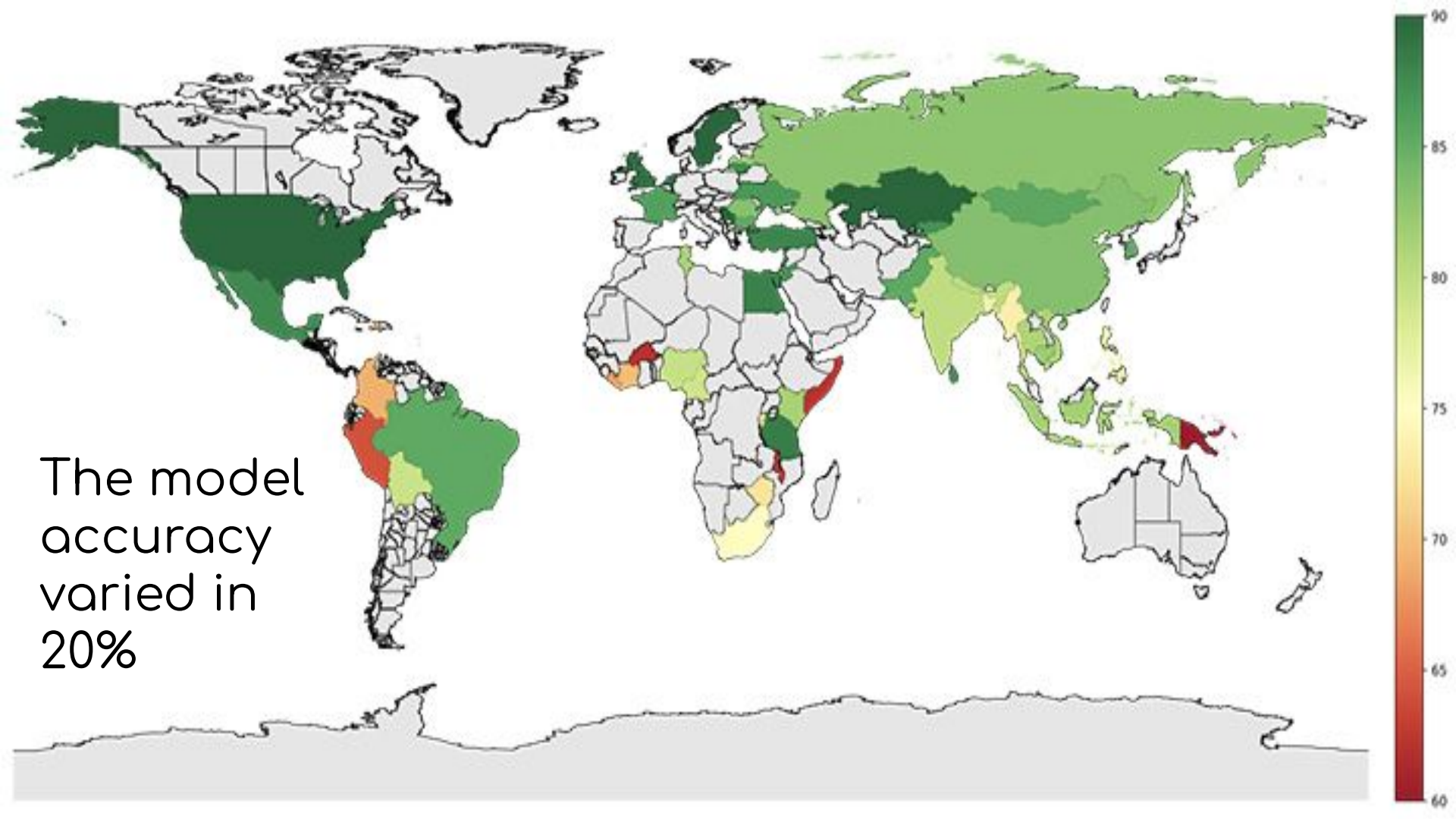
Toothpaste

Country of Origin: Burundi
Prediction: Wood

Country of Origin: UK
Prediction: Toiletry

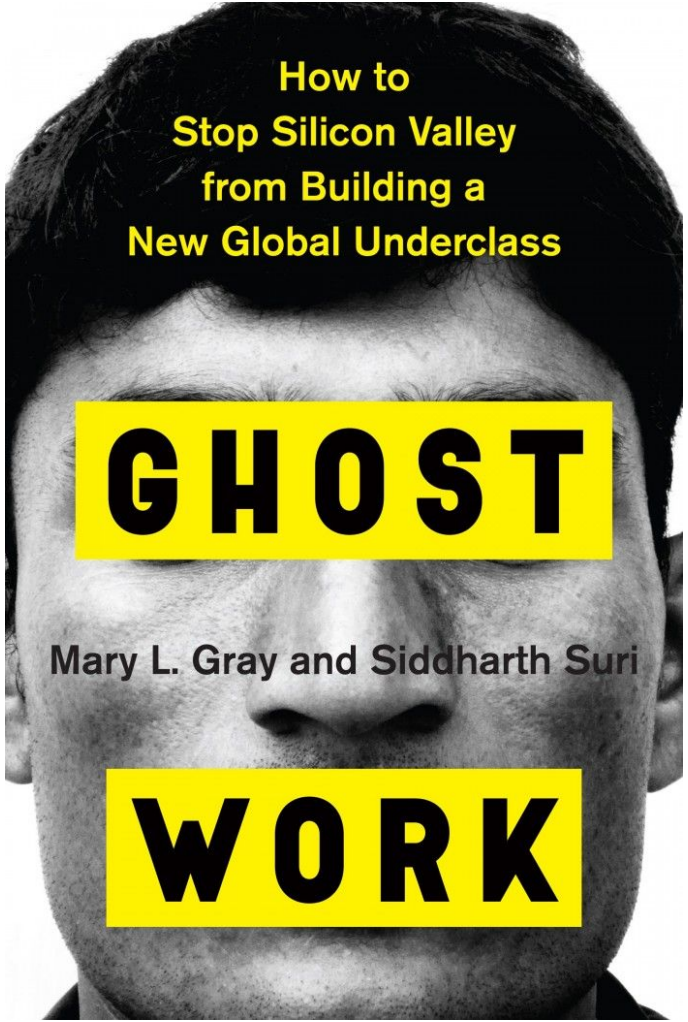
Country of Origin: USA
Prediction: Spice

Country of Origin: USA
Prediction: Toothpaste



The model accuracy varied in 20%

controversy ++



Behind Facebook's content-moderating AI are thousands of content moderators; behind Amazon Alexa is a global team of transcribers; and behind Google Duplex are sometimes very human callers mimicking the AI that mimics humans.

Who or what is guilty when you are harmed by an algorithm?

http://bit.do/ubercrash

Machine vs Machine

Big Data

http://www.showmetech.com.br/big-data-trump/

DISINFORMATION WARFARE

https://www.youtube.com/watch?v=tR_6dibpDfo

Como as 'fake news' no WhatsApp levaram um povoado a linchar e queimar dois homens inocentes

Marcos Martínez
BBC Monitoring

14 novembro 2018

05/05/2014 09h44 - Atualizado em 05/05/2014 10h13

Mulher espancada após boatos em rede social morre em Guarujá, SP

Ela foi agredida após ser acusada de praticar magia negra com crianças. Moradores registraram vídeos mostrando a agressão e postaram na web.

FACEBOOK

Boatos de Whatsapp sobre traficantes de crianças deflagram onda de linchamentos na Índia

Polícia fez apelo para que pessoas não ataquem ninguém com base em suspeitas. Uma mendiga morreu após ser agredida por cerca de cem pessoas.

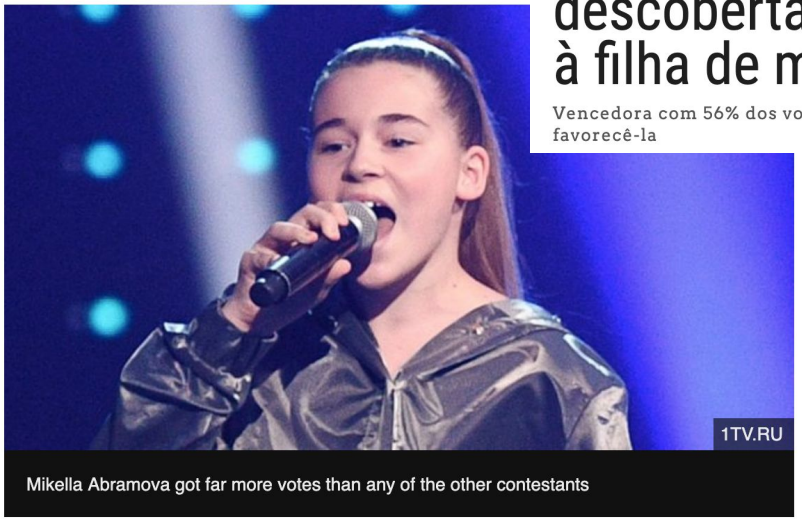
https://www.bbc.com/news/amp/world-europe-48293196

BBC NEWS

Home | UK | World | Business | Politics | Tech | Science | More

Russian bots rigged Voice Kids TV talent show result

16 May 2019 | Europe



Mikella Abramova got far more votes than any of the other contestants

PUBLICADA EM: 16/05/2019 - 15H58

‘The Voice Kids’ russo é cancelado após descoberta de esquema de robôs para dar votos à filha de milionário

Vencedora com 56% dos votos do público, Mikella Abramova teria recebido vários votos de números programados para favorecê-la

Internet Vs Black Forest Theory

#deepfake

Samsung use AI to transform one pic into a video

6.08233v1 [cs.CV] 20 May 2019

Few-Shot Adversarial Learning of Realistic Neural Talking Head Models

Egor Zakharov[1,2] Aliaksandra Shysheya[1,2] Egor Burkov[1,2] Victor Lempitsky[1,2]

[1]Samsung AI Center, Moscow [2]Skolkovo Institute of Science and Technology

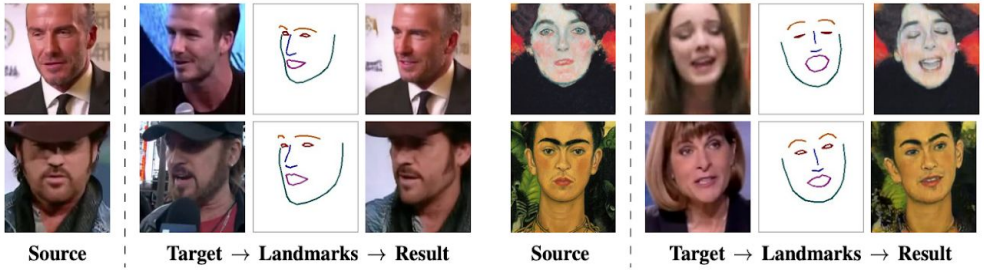
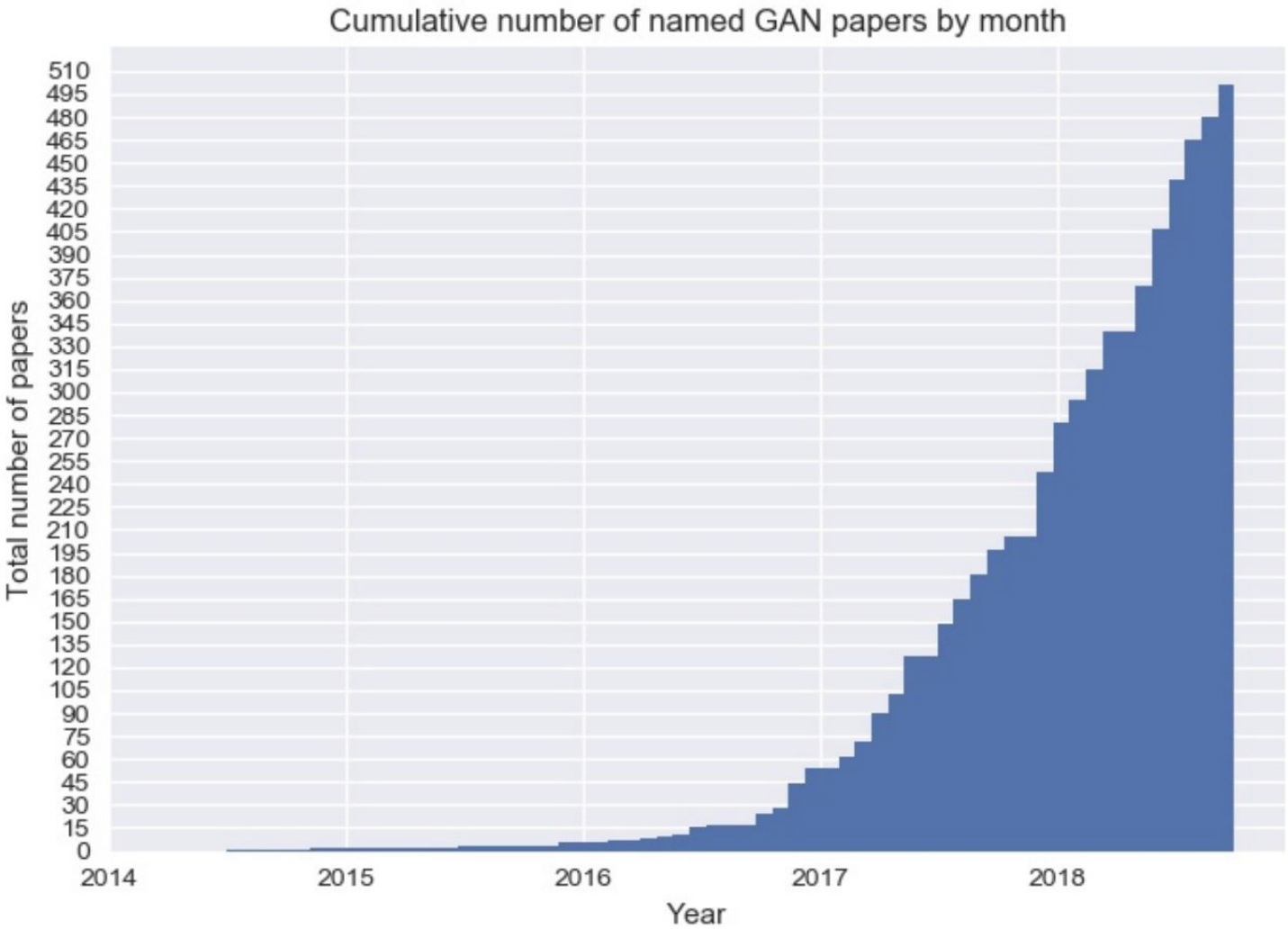


Figure 1: The results of talking head image synthesis using face landmark tracks extracted from a different video sequence of the same person (on the left), and using face landmarks of a different person (on the right). The **results** are conditioned on the **landmarks** taken from the **target** frame, while the **source** frame is an example from the training set. The talking head models on the left were trained using eight frames, while the models on the right were trained in a one-shot manner.

Abstract

Several recent works have shown how highly realistic human head images can be obtained by training convolutional neural networks to generate them. In order to create a personalized talking head model, these works require training on a large dataset of images of a single person. However, in many practical scenarios, such personalized

can synthesize plausible video-sequences of speech expressions and mimics of a particular individual. More specifically, we consider the problem of synthesizing photorealistic personalized head images given a set of face landmarks, which drive the animation of the model. Such ability has practical applications for telepresence, including videoconferencing and multi-player games, as well as special effects industry. Synthesizing realistic talking head sequences


Cumulative number of named GAN papers by month
Total number of papers
510
495
480
465
450
435
420
405
390
375
360
345
330
315
300
285
270
255
240
225
210
195
180
165
150
135
120
105
90
75
60
45
30
15
0
2014
2015
2016
2017
2018
Year

Yoshua Bengio

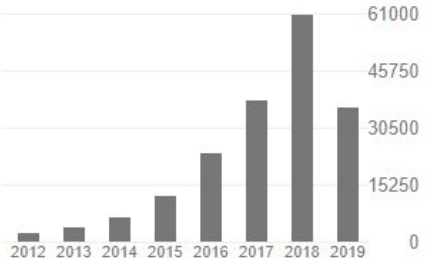
FOLLOW

Professor, U. Montreal (Computer Sc. & Op. Res.), Mila, CIFAR, CRM, IVADO, REPARTI, GRSNC
Verified email at mila.quebec - Homepage
Machine learning deep learning artificial intelligence

TITLE	CITED BY	YEAR
Gradient-based learning applied to document recognition Y LeCun, L Bottou, Y Bengio, P Haffner Proceedings of the IEEE 86 (11), 2278-2324	19732	1998
Deep learning Y LeCun, Y Bengio, G Hinton nature 521 (7553), 436	16898	2015
Generative adversarial nets I Goodfellow, J Pouget-Abadie, M Mirza, B Xu, D Warde-Farley, S Ozair, ... Advances in neural information processing systems, 2672-2680	10343	2014
Deep learning I Goodfellow, Y Bengio, A Courville MIT press	8738	2016
Neural machine translation by jointly learning to align and translate D Bahdanau, K Cho, Y Bengio arXiv preprint arXiv:1409.0473	7583	2014
Learning deep architectures for AI Y Bengio Foundations and trends® in Machine Learning 2 (1), 1-127	6904	2009
Understanding the difficulty of training deep feedforward neural networks X Glorot, Y Bengio Proceedings of the thirteenth international conference on artificial ...	5939	2010

Cited by VIEW ALL

	All	Since 2014
Citations	197048	178354
h-index	144	133
i10-index	463	405



Co-authors VIEW ALL

- Aaron Courville — Université de Montréal
- Pascal Vincent — Facebook AI Research; U. Montr...
- Kyunghyun Cho — New York University, Facebook ...
- Ian Goodfellow
- Yann LeCun — Chief AI Scientist at Facebook & ...

The registry office of the FUTURE

http://bit.do/deepfakecartorio

Tools and Programming Languages

AI Open Source

Introducing Ludwig, a Code-Free Deep Learning Toolbox

Piero Molino, Yaroslav Dudin, and Sai Sumanth Miryala

February 11, 2019

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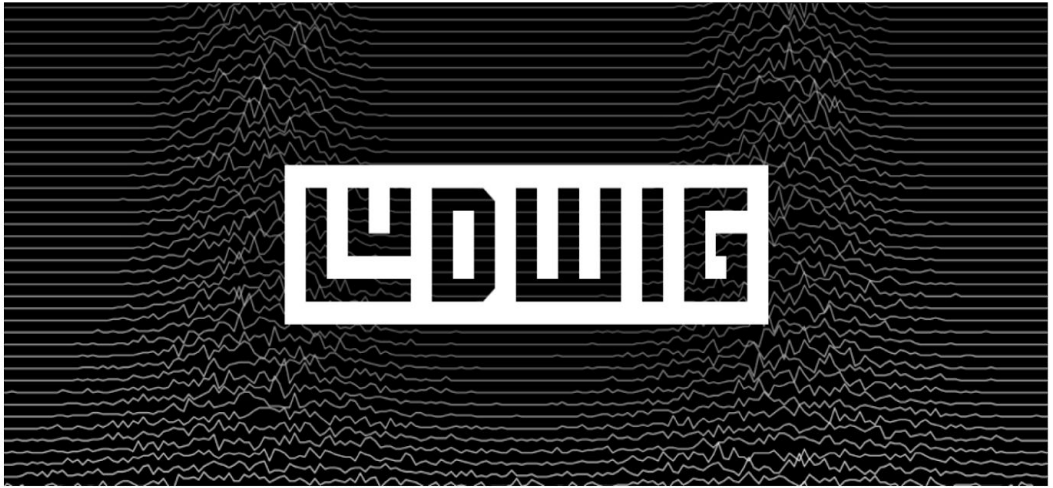
Reddit



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September 5, 2017

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Ludwig is a toolbox built on top of TensorFlow that allows to train and test deep learning models without the need to write code.
http://uber.github.io/ludwig/

deep-learning deeplearning deep-neural-networks deep learning machine-learning machinelearning machine
natural-language-processing natural-language-understanding natural-language natural-language-generation computer-vision python3

435 commits | 4 branches | 3 releases | 42 contributors | Apache-2.0

Branch: master | New pull request | Create new file | Upload files | Find File | Clone or download

w4nderlust Fix embedding size in parallel cnn encoder — Latest commit 2216846 8 hours ago

.github	Fixes for typos and example inconsistencies in the documentation (#207)	3 months ago
docs	Add BERT tokenizer (#380)	9 hours ago
ludwig	Fix embedding size in parallel cnn encoder	8 hours ago
mkdocs	Add BERT tokenizer (#380)	9 hours ago
tests	Added normalization strategies for numerical features (#367)	7 days ago

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Facebook AI
@facebookai

Facebook AI focuses on connecting people to what they care about, powering meaningful and safe experiences, advancing ML, and conducting open research.

Joined August 2018

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Facebook AI
@facebookai

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We're open sourcing Pythia, a deep learning framework that supports multitasking for vision and language tasks. It's built on PyTorch, and researchers can use Pythia to more easily build, reproduce, and benchmark #AI models.

Pythia: open-source framework for multimodal AI models - Facebook Code
Pythia is a new open source deep learning framework that enables researchers to quickly build, reproduce, and benchmark AI models.
code.fb.com

10:31 AM - 21 May 2019

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A modular framework for vision & language multimodal research from Facebook AI Research (FAIR) https://learnpythia.readthedocs.io/

pytorch vqa pretrained-models pythia multimodal deep-learning captioning dialog

313 commits | 6 branches | 1 release | 11 contributors | View license

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apsdehal [feat] Add script for feature extraction from vmb (#93) ... Latest commit c6796cc 7 days ago

.circleci	[tests] CircleCI: Lint code for undefined names (#60)	27 days ago
.github/ISSUE_TEMPLATE	[chores] Add templates for github issues	17 days ago
configs	[feature] Adding Image captioning to Pythia (#55)	18 days ago
docs	[docs] Update butd to coco in docs	12 days ago
pythia	[feat] Add script for feature extraction from vmb (#93)	7 days ago
tests	[tests] Adding tests for captioning losses and metrics (#88)	8 days ago

julia
R

python™

visualize

Seaborn

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Bokeh

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analyze

Keras

PYTORCH

scikit learn

pgmpy

NetworkX

PyMC3

PyGSP

collect, pre-processing, prepare

NumPy

pandas

$y_i t = \beta' x_{it} + \mu_i + \epsilon_{it}$

jupyter Untitled (unsaved changes)

File Edit View Insert Cell Kernel Help Python 2

Code CellToolbar

Simple Jupyter demo

This cell has text formatted using the markdown language, which gets rendered like regular html. The next cell has some code:

In [57]:
```
import random
for i in range(3):
    print random.random()
x = 10
```

```
0.10564822904
0.153941700348
0.518503128416
```

Here is another text cell, with some *formatting*.

Sponsors

Project Jupyter receives direct funding from the following sources:

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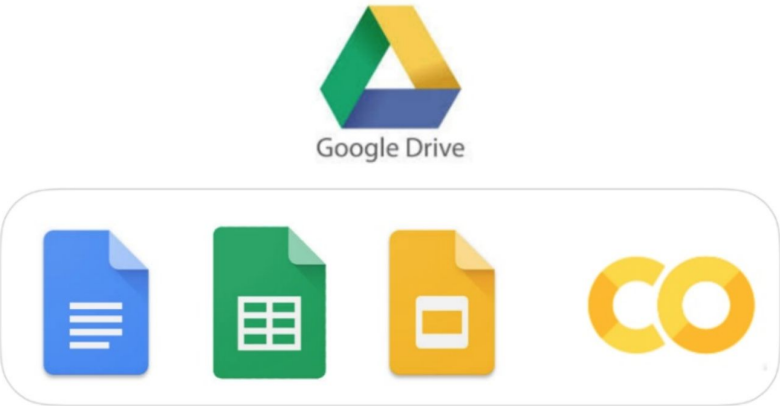
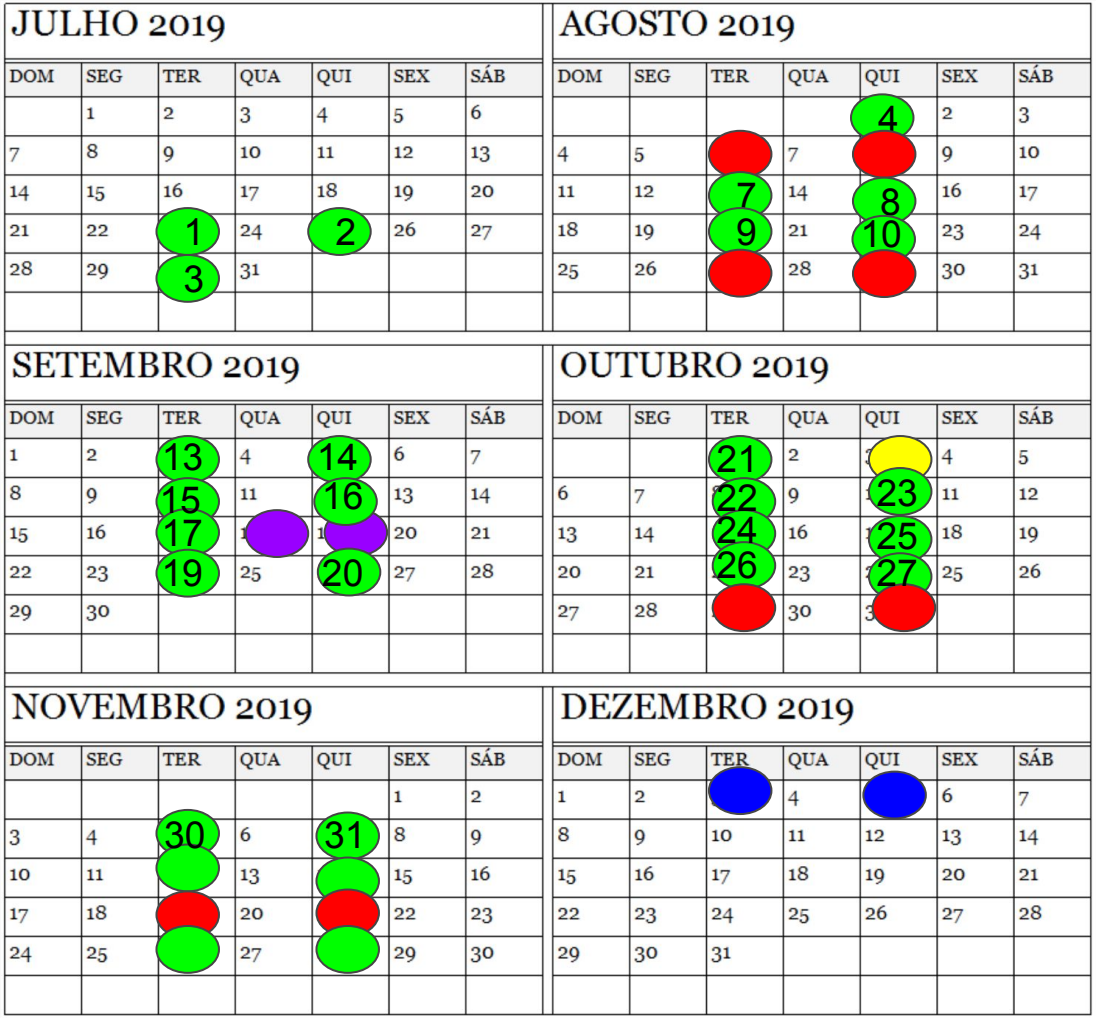


Colaboratory is a Google research project created to help disseminate machine learning education and research. It's a Jupyter notebook environment that requires no setup to use and runs entirely in the cloud.

Colaboratory notebooks are stored in Google Drive and can be shared just as you would with Google Docs or Sheets. Colaboratory is free to use.

https://towardsdatascience.com/google-colab-your-python-workspace-on-cloud-c3aed424de0d



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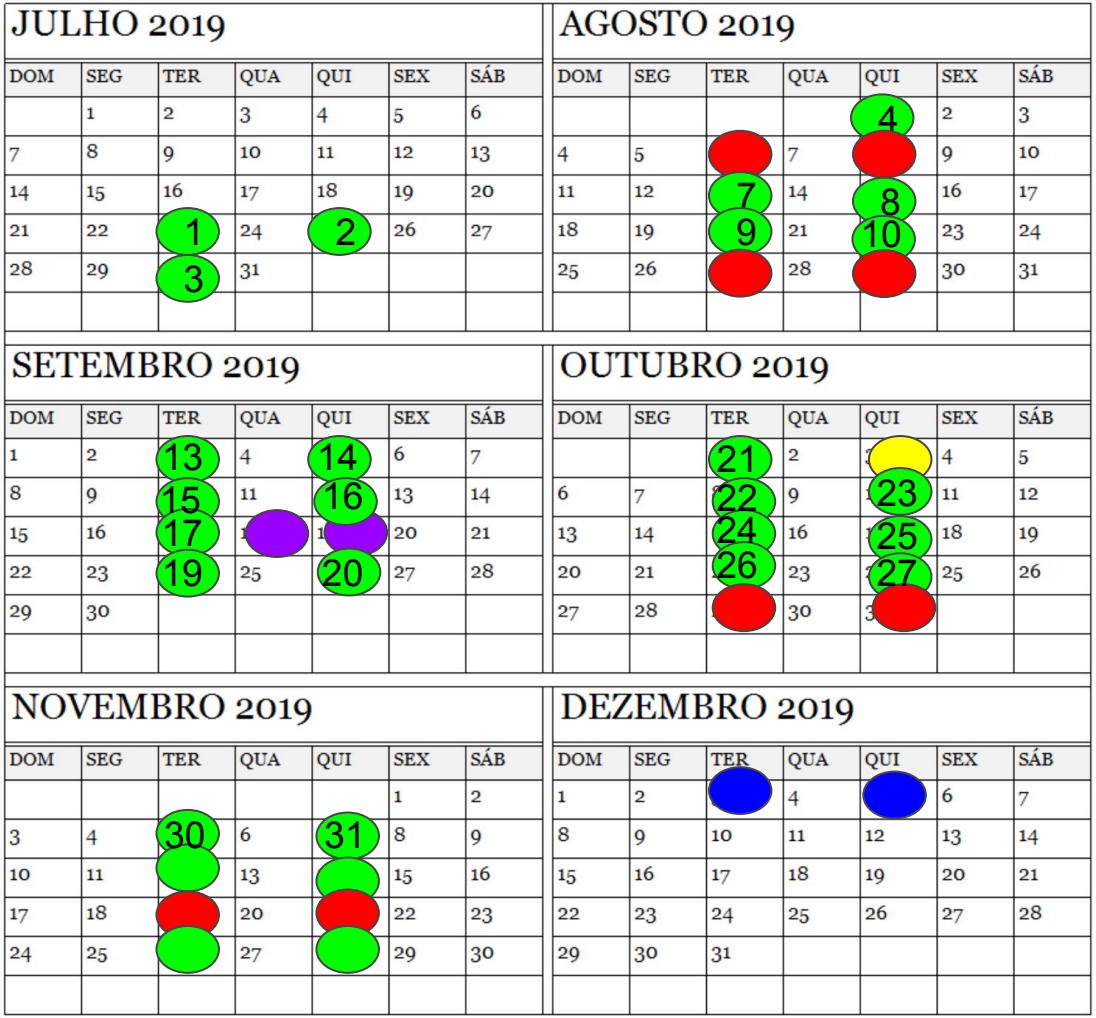
21. XGBoost + Gridsearch
22. Kaggle Competitions
23. Kaggle Competitions



24. Neural Networks
25. Neural Networks
26. Kaggle Competitions Challenge
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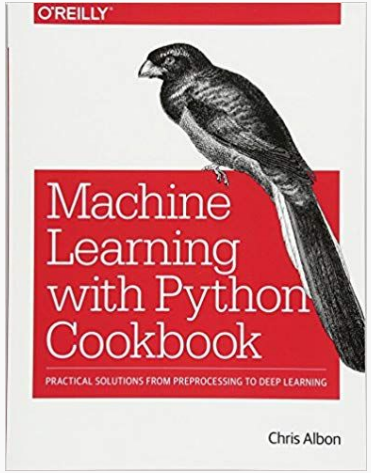
28. Kaggle Competitions Challenge
29. Kaggle Competitions Challenge
30. Deep Learning Fundamentals with Keras
31. Deep Learning Fundamentals with Keras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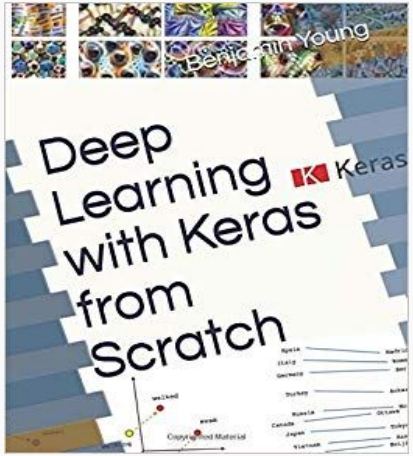
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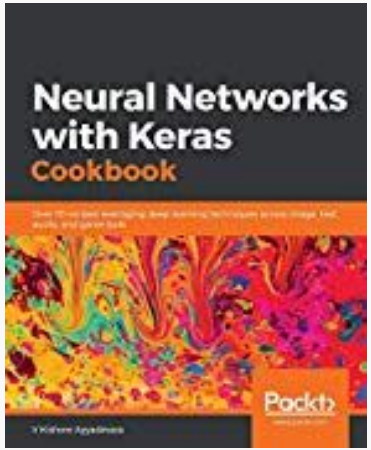
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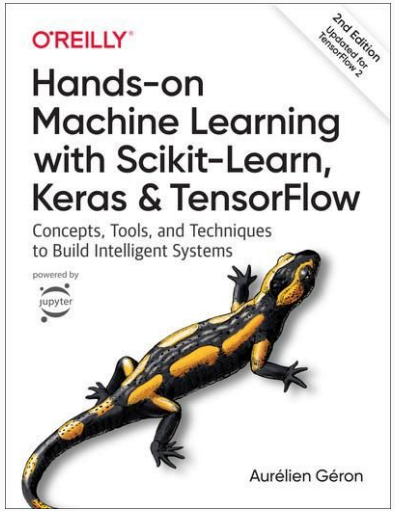
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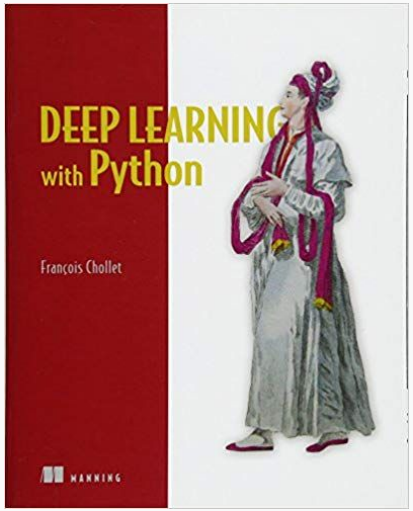
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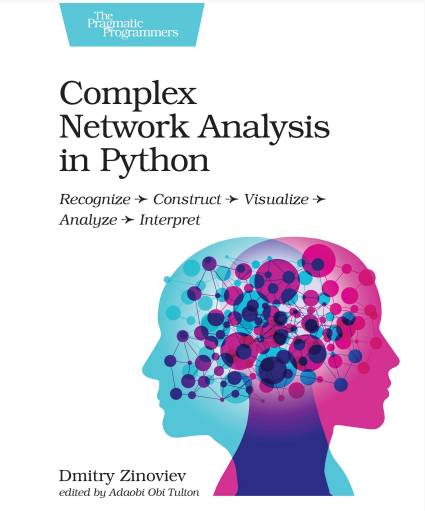
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NEW: I am a member of the newly established Cornell Center of Data Science for Improved Decision-Making. My CS4780 Machine Learning for Intelligent Systems class is now online.

Bio: Kilian Weinberger is an Associate Professor in the Department of Computer Science at Cornell University. He received his Ph.D. from the University of Pennsylvania in Machine Learning under the supervision of Lawrence Saul and his undergraduate degree in Mathematics and Computing from the University of Oxford. During his career he has won several best paper awards at ICML (2004), CVPR (2004, 2017), AISTATS (2005) and KDD (2014, runner-up award). In 2011 he was awarded the Outstanding AAAI Senior Program Chair Award and in 2012 he received an NSF CAREER award. He was elected co-Program Chair for ICML 2016 and for AAAI 2018. In 2016 he was the recipient of the Daniel M Lazar '29 Excellence in Teaching Award. Kilian Weinberger's research focuses on Machine Learning and its applications. In particular, he focuses on learning under resource constraints, metric learning, Gaussian Processes, computer vision and deep learning. Before joining Cornell University, he was an Associate Professor at Washington University in St. Louis and before that he worked as a research scientist at Yahoo! Research in Santa Clara. (C.V..)

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Jet-Sing M. Lee

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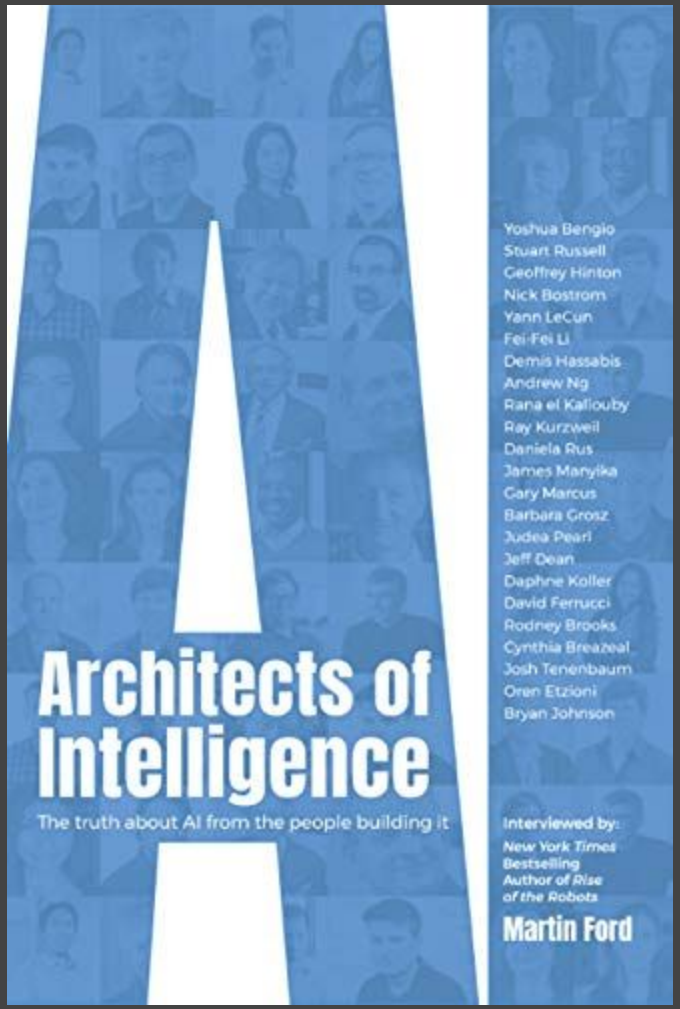
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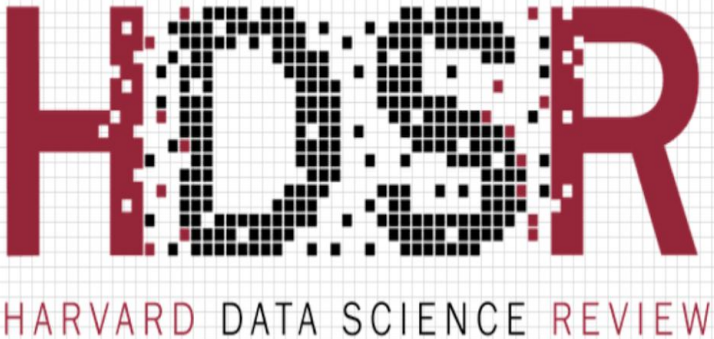

A Microscopic, Telescopic, and Kaleidoscopic View of Data Science

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From the Editor-in-Chief, Xiao-Li Meng

Data Science: An Artificial Ecosystem

HOMEWORK!!!

ivanovitchm / datascience_one_2019_1

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