Deep Learning Passo a Passo

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2019

Sumário

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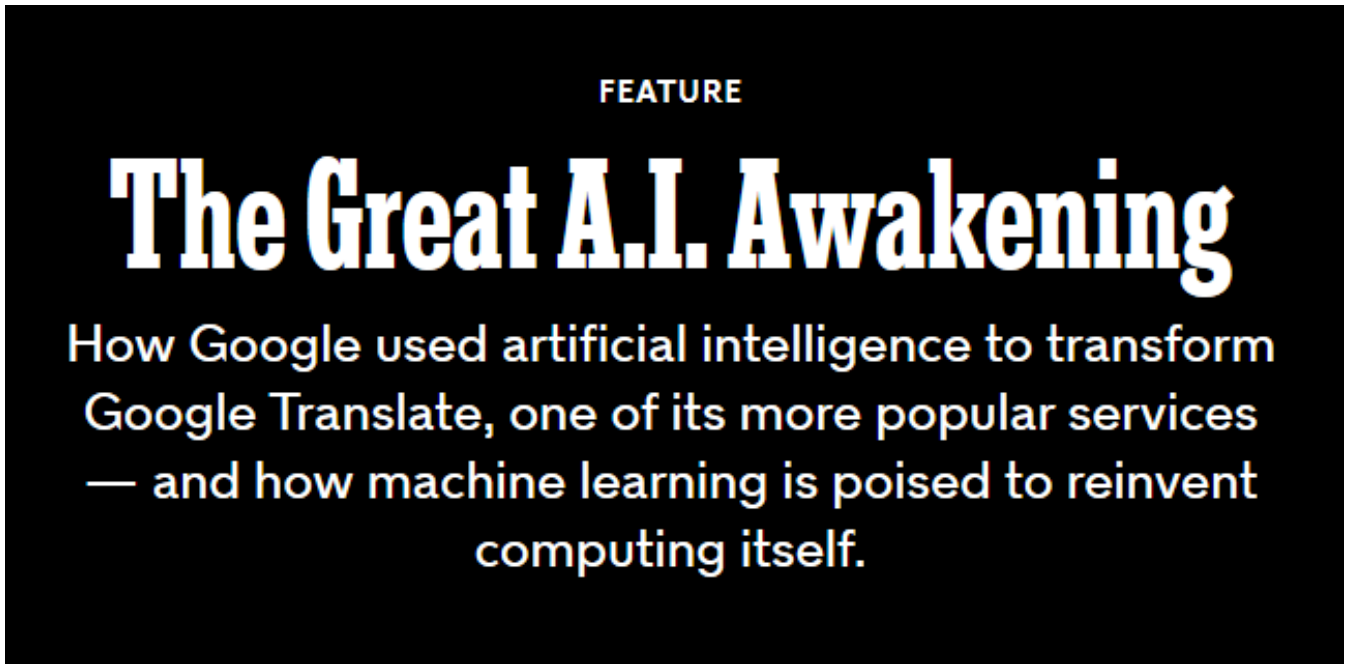
2. O que é Deep Learning?
3. Avanços técnicos nas últimas décadas
4. Mão na massa: ferramentas para praticar

Uma revisão dos sucessos recentes de Deep Learning

Tradutor

Numa noite de novembro de 2016, o Google Tradutor subitamente melhorou muitíssimo. Na manhã do dia seguinte, era o tópico #1 no Twitter japonês.



NYT 2016-12-14

Jogo de Go

NYT 2017-05-25

Google's A.I. Program Rattles Chinese Go Master as It Wins Match

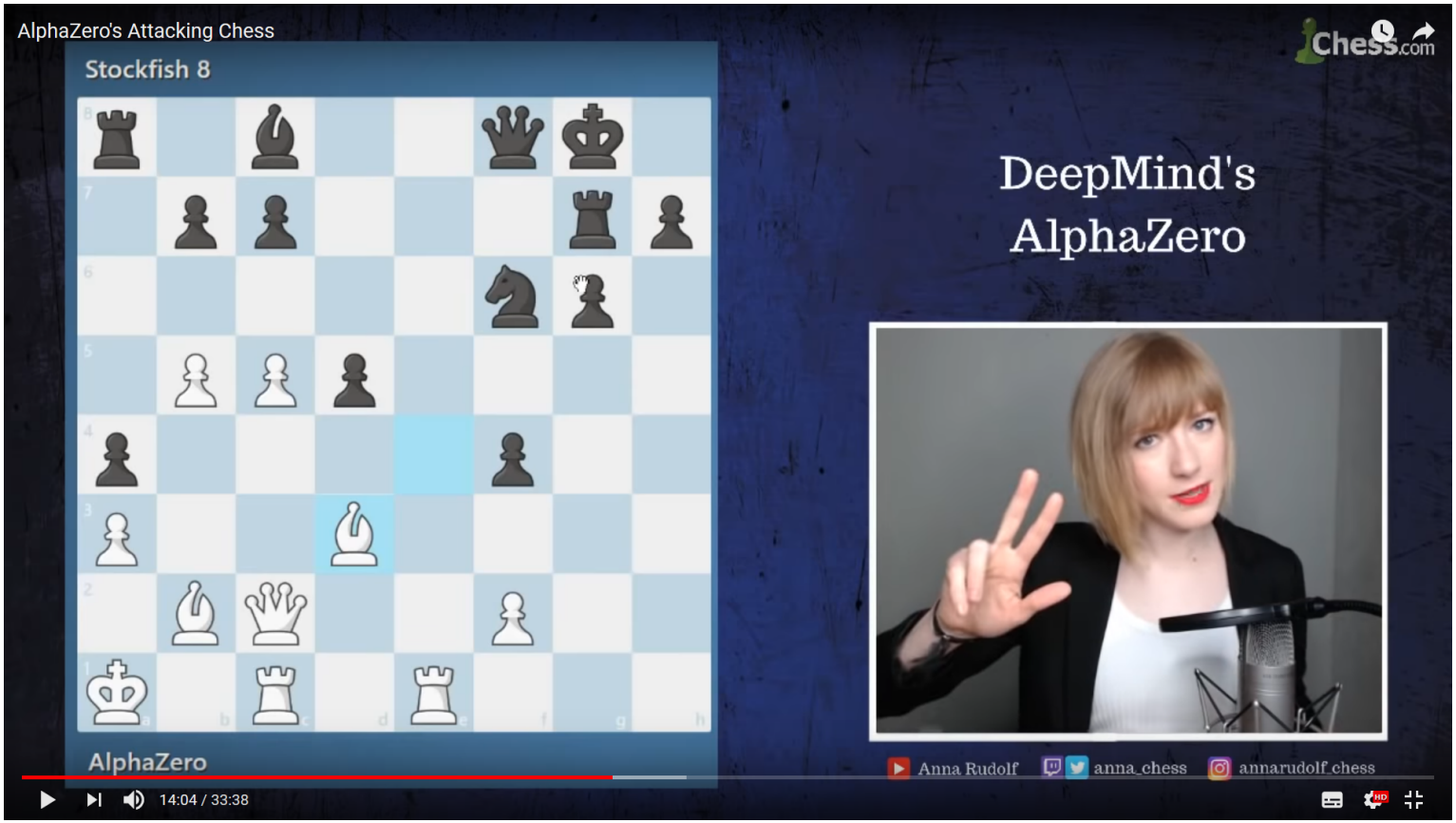
Lee Sedol

Ke Jie

Google AI beats Go world champion again to complete historic 4-1 series victory

NYT 2016-03-15

Alpha Zero: aprende com *self-play*



`https://www.youtube.com/watch?v=nPexHaFL1uo`

Paper: D Silver *et al.*; A general reinforcement learning algorithm . . . , *Science* 362 (6419), pp. 1140-1144, 07 Dec 2018

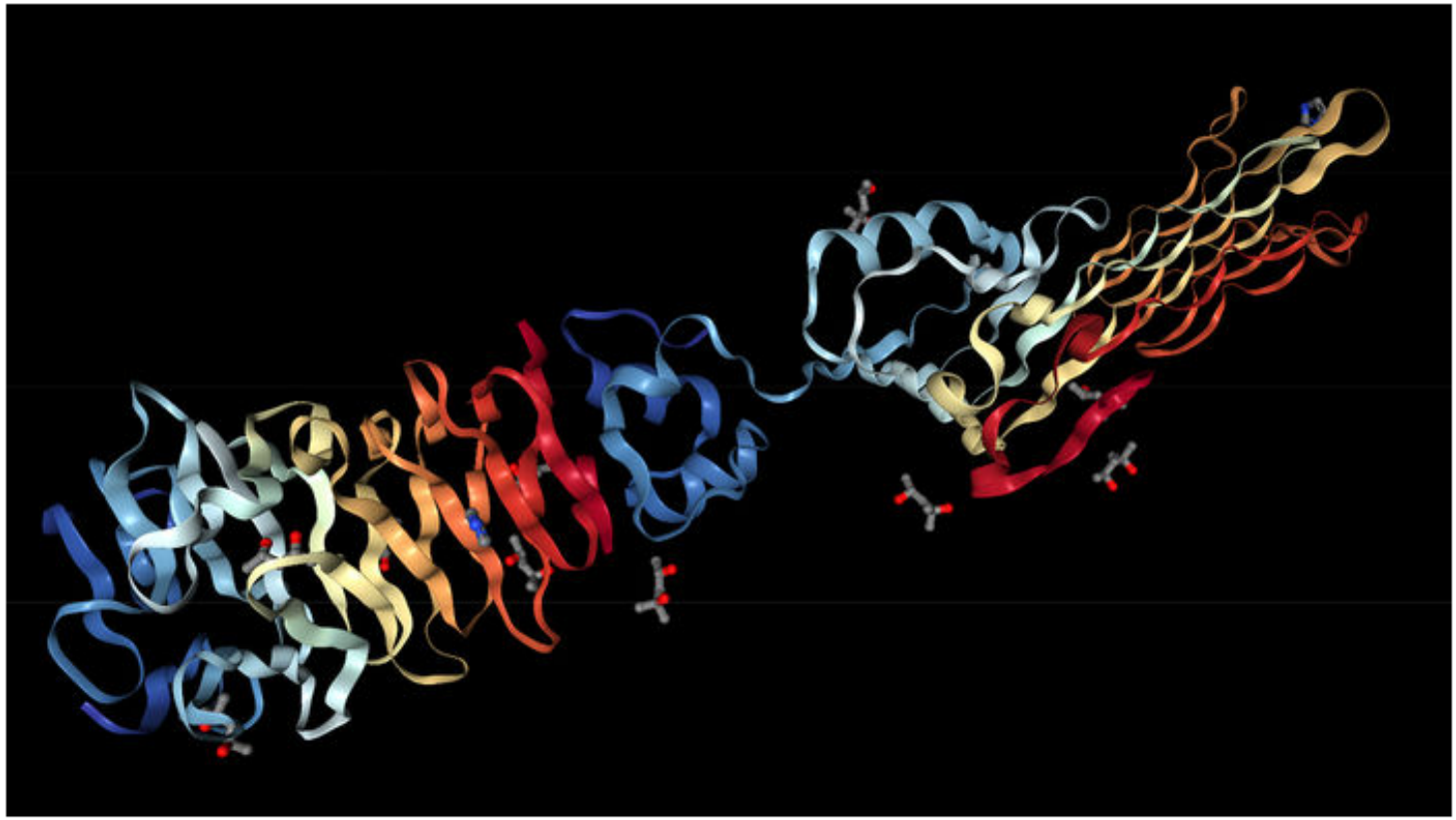
Fake people

These People Are Not Real—They Were Created By AI

J Pearson; Motherboard, Dec 14 2018, 2:39pm

Paper: T Karras, S Laine, T Aila; A Style-Based Generator Architecture for Generative Adversarial Networks, arXiv 1812.04948

AlphaFold: enovelamento de proteínas



Complex of bacteria-infecting viral proteins modeled in CASP 13. The complex contains four separate subunits that were modeled individually. PROTEIN DATA BANK

Google's DeepMind aces protein folding

By Robert F. Service | Dec. 6, 2018 , 12:05 PM

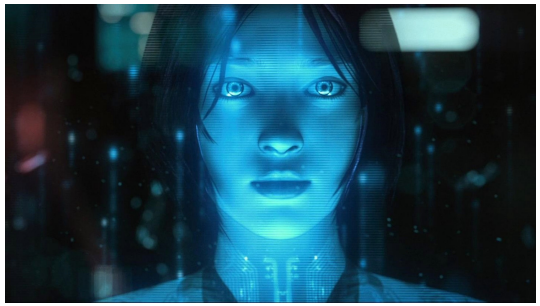
https://www.sciencemag.org/news/2018/12/

Outras aplicações

Assistentes virtuais

Alexa

Cortana

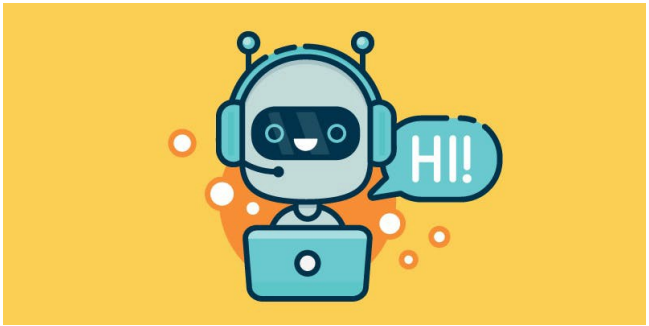


Siri

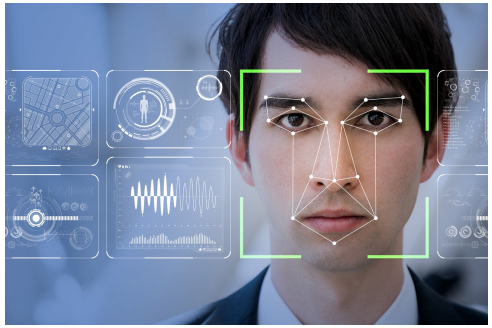
Veículos autônomos

Mais aplicações

Chatbots



Reconhecimento facial

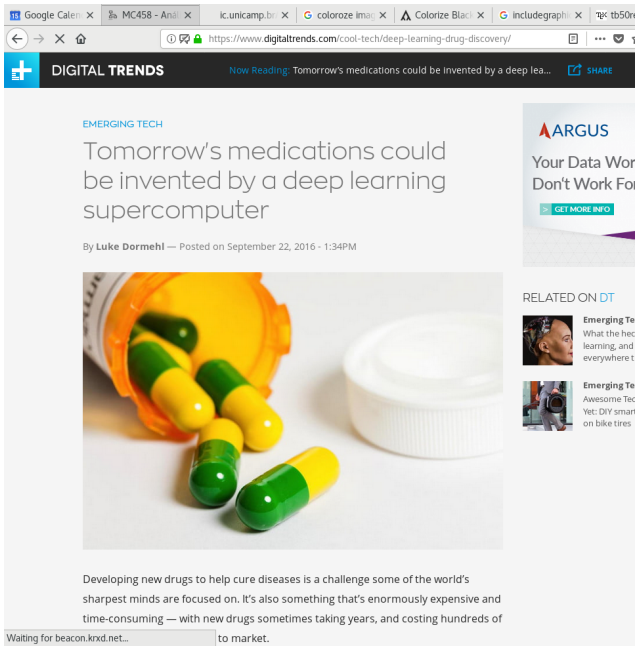


Colorir imagens P&B

`https://demos.algorithmia.com/colorize-photos/`

Mais aplicações ainda

Medicina e fármacos



Recomendações

`https://www.digitaltrends.com/cool-tech/deep-learning-drug-discovery/`

O que é Deep Learning?

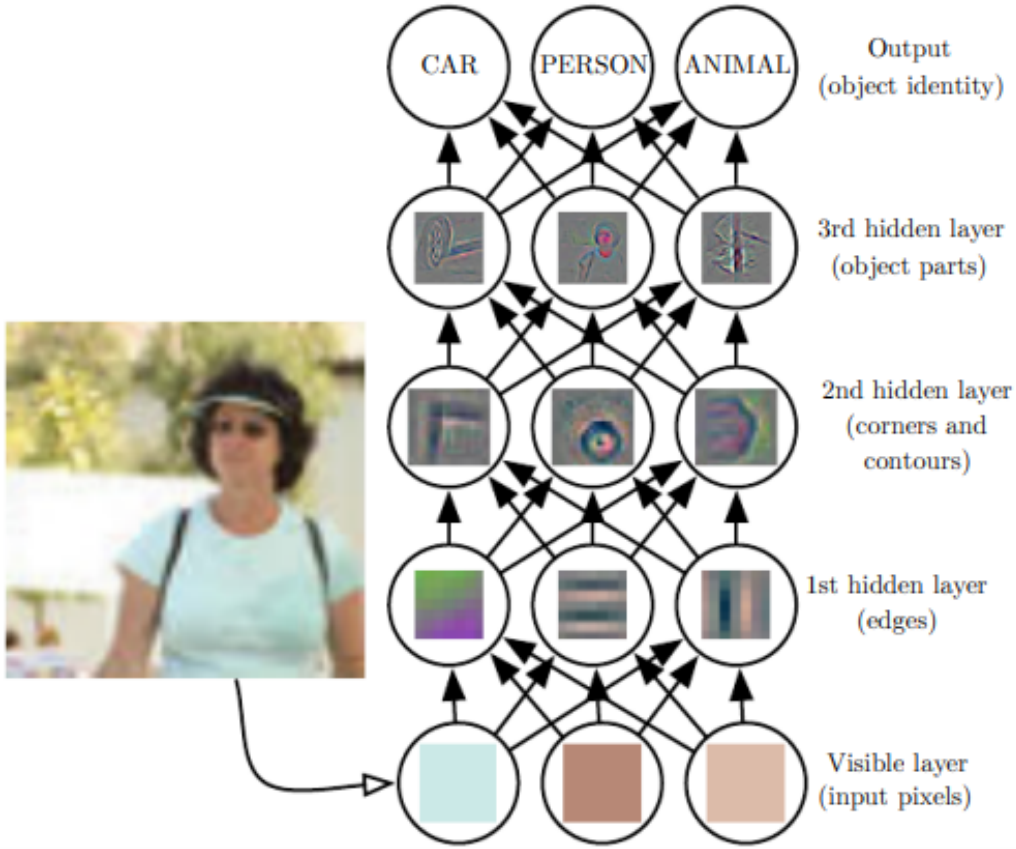
Deep Learning

Deep Learning: rede neural

- Redes neurais com *muitas* camadas: redes *profundas*
- Conseguem "aprender" conceitos mais sofisticados

- Maior volume de dados
- Computadores mais potentes

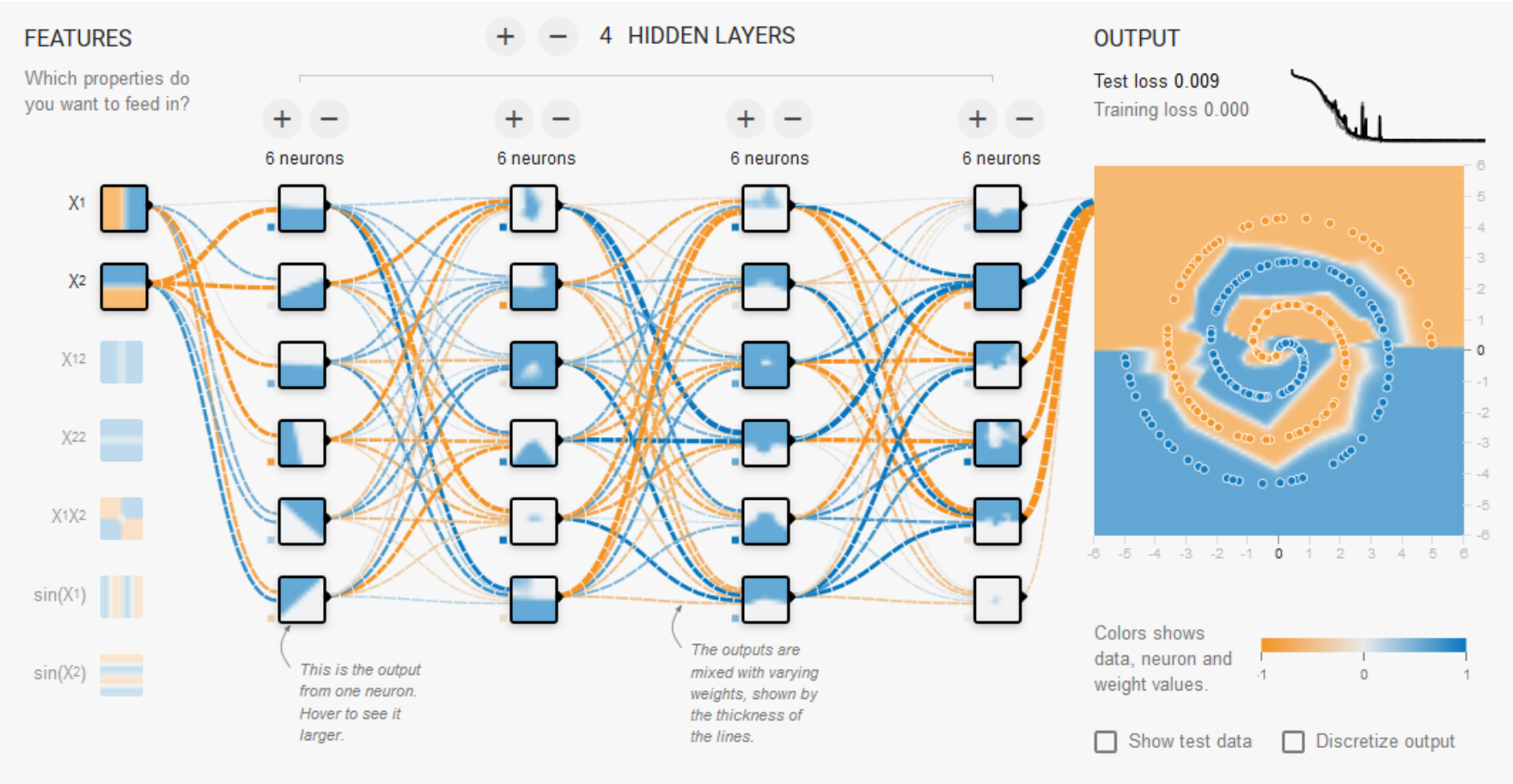
Aprendendo conceitos sofisticados



Source: I Goodfellow, Y Bengio, A Courville; *Deep Learning*, MIT Press, 2016, p.6

Rede neural: exemplo

Neurônios, camadas, predição, *feedback*



https://playground.tensorflow.org/

Avanços técnicos nas últimas décadas

1960..1970: Backpropagation

Como propagar o *feedback* ao longo da rede eficientemente

Backpropagation: a simple example

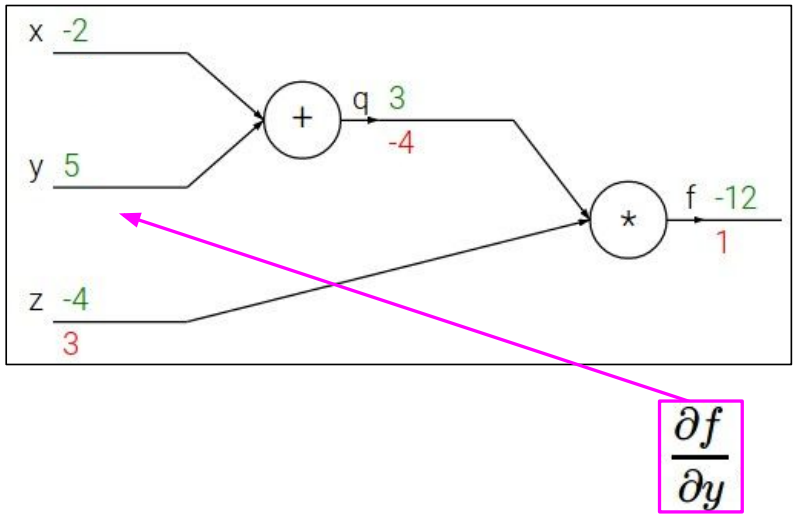
$$f(x, y, z) = (x + y)z$$

e.g. x = -2, y = 5, z = -4

$$q = x + y \qquad \frac{\partial q}{\partial x} = 1, \frac{\partial q}{\partial y} = 1$$

$$f = qz \qquad \frac{\partial f}{\partial q} = z, \frac{\partial f}{\partial z} = q$$

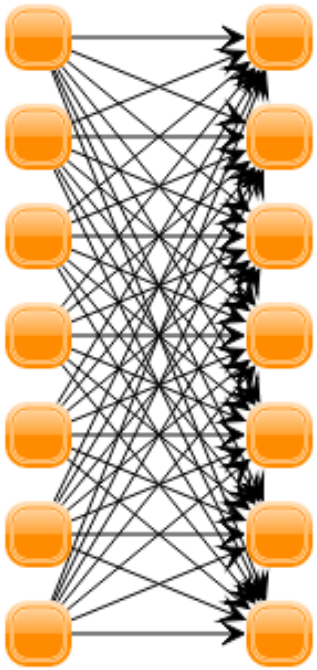
Want: $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}, \frac{\partial f}{\partial z}$



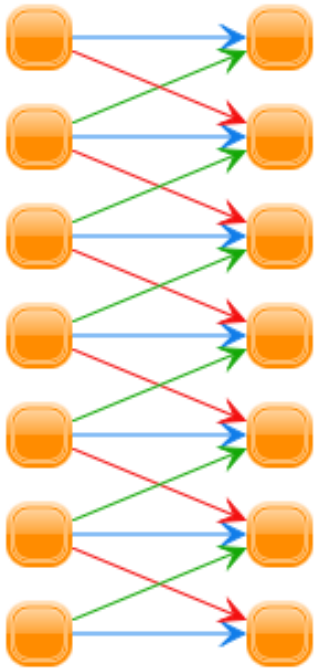
http://cs231n.stanford.edu/slides/2017/cs231n_2017_lecture4.pdf

1980..1990: Camadas convolucionais

Em vez de todos para todos, próximos para próximos.
Muito usado para 2 ou 3 dimensões.



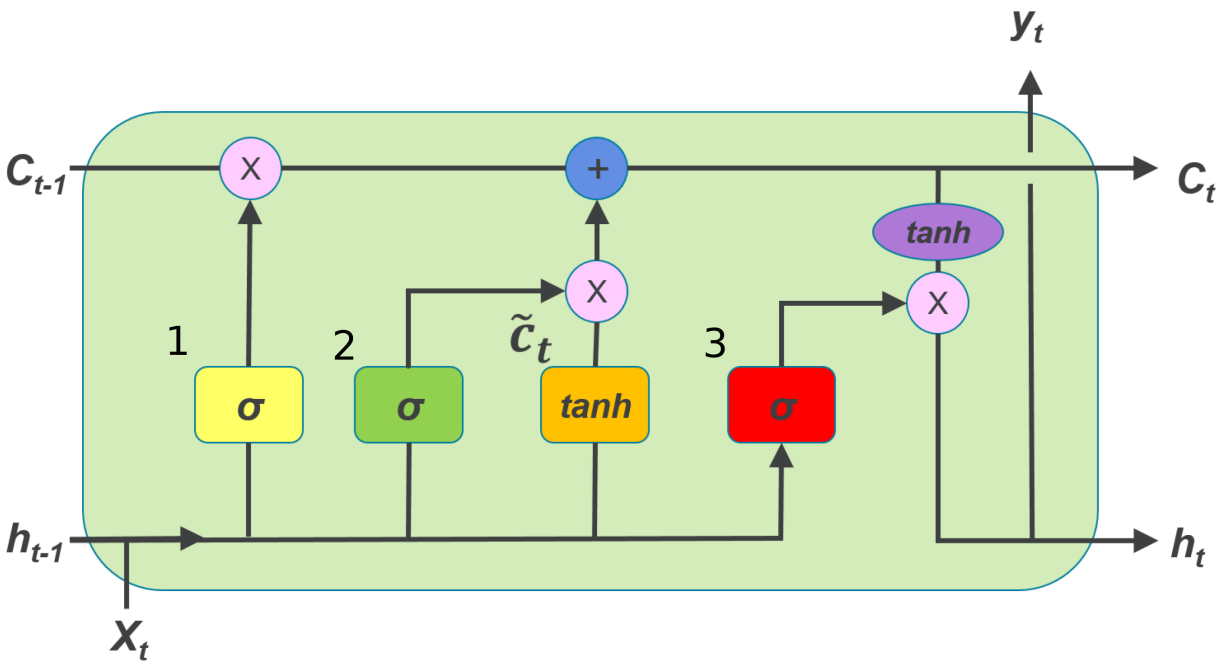
Transição DENSA
Pesos independentes



Transição CONVOLUCIONAL
Pesos em comum

1990..2000: Neurônios LSTM (Long Short-Term Memory)

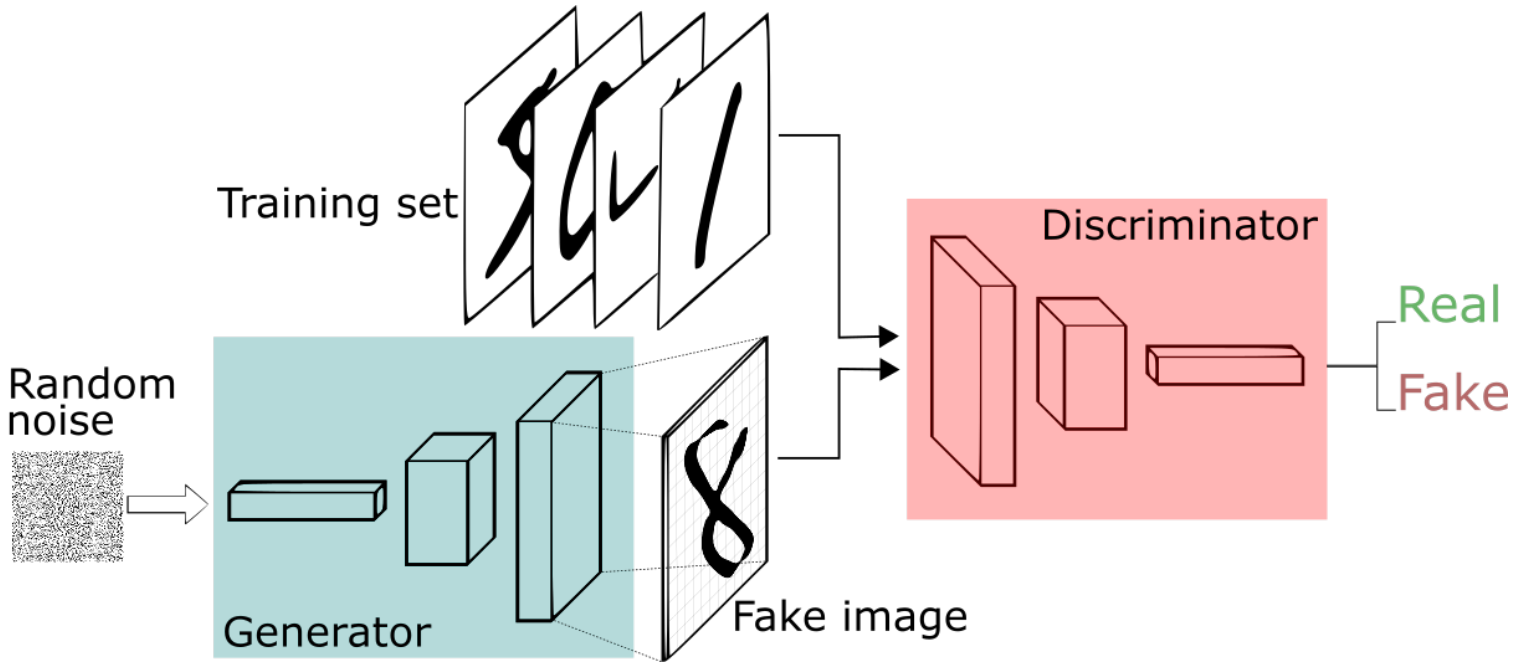
Neurônios especiais para sequências. Têm memória de curto e longo prazos. Úteis em tradução, outras aplicações com textos, etc.



Exemplo de rede que aprende a escrever como Shakespeare, fazer artigos da Wikipedia, etc.: `http://karpathy.github.io/2015/05/21/rnn-effectiveness/`

2014: GAN (Generative Adversarial Networks)

Redes que geram fotos que parecem de verdade, colocam cabeça de artista em qualquer corpo, geram imagens a partir de descrição textual, etc.



https://skymind.ai/wiki/generative-adversarial-network-gan

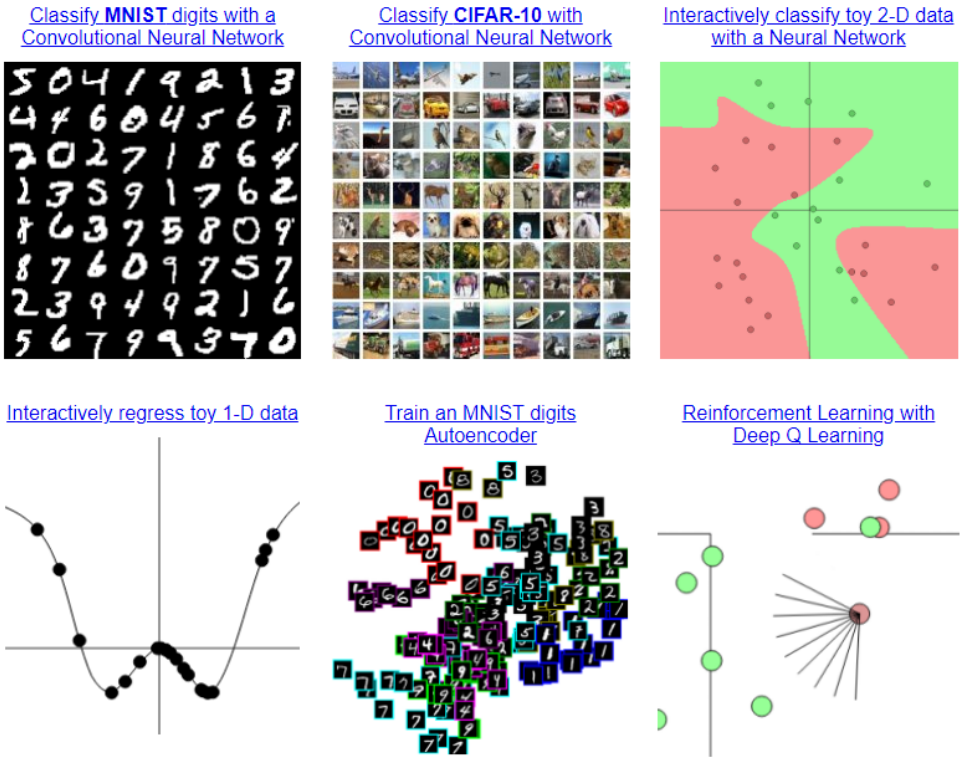
Mão na massa: ferramentas para praticar

Frameworks, Dados, Competições

- Deep Learning in your browser
  https://cs.stanford.edu/people/karpathy/convnetjs/index.html
- Kaggle
  https://www.kaggle.com/
  - Competições
  - Dados
  - Cadernos (Notebooks)
  - Cursos
- TensorFlow
  https://www.tensorflow.org/tutorials/
- Fast.ai e PyTorch
  http://www.fast.ai/

ConvNetJS

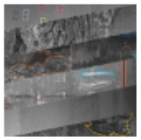
Deep Learning no seu navegador!



https://cs.stanford.edu/people/karpathy/convnetjs/index.html

Kaggle — Competições, dados, e mais!

Competições — exemplos



Severstal: Steel Defect Detection
Can you detect and classify defects in steel?
Featured · Kernels Competition · 3 months to go · manufacturing, image data

$120,000
273 teams

Two Sigma: Using News to Predict Stock Movements
Use news analytics to predict stock price performance
Featured · Kernels Competition · 3 days to go · news agencies, time series, finance, money

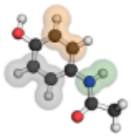
$100,000
2,927 teams

APTOS 2019 Blindness Detection
Detect diabetic retinopathy to stop blindness before it's too late
Featured · Kernels Competition · a month to go · healthcare, medicine, image data, multiclass classi...

$50,000
2,073 teams

SIIM-ACR Pneumothorax Segmentation
Identify Pneumothorax disease in chest x-rays
Featured · a month to go · image data, object segmentation

$30,000
1,257 teams

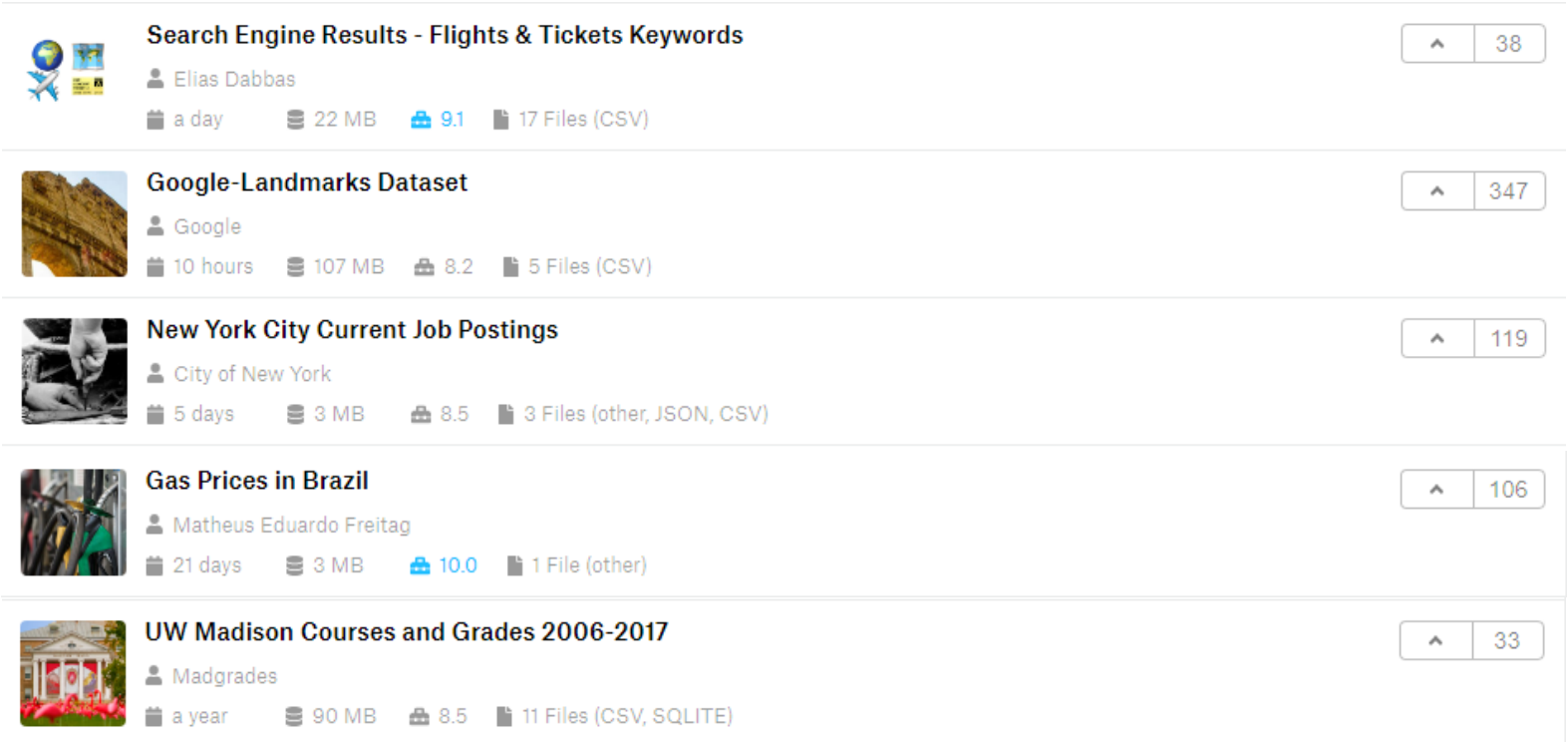


Predicting Molecular Properties
Can you measure the magnetic interactions between a pair of atoms?
Featured · a month to go · chemistry, tabular data, regression

$30,000
2,269 teams

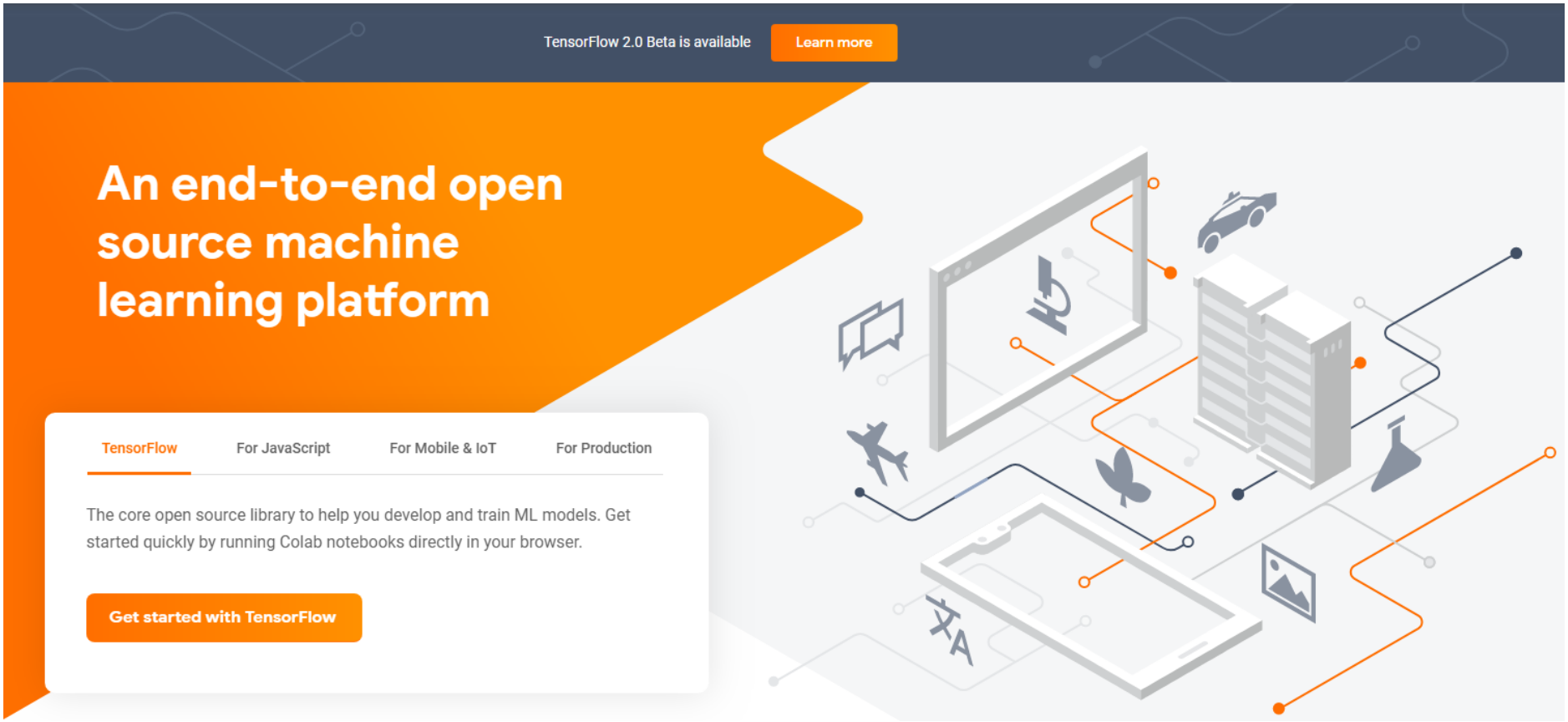
Kaggle — Competições, dados, e mais!

Dados — exemplos



https://www.kaggle.com/

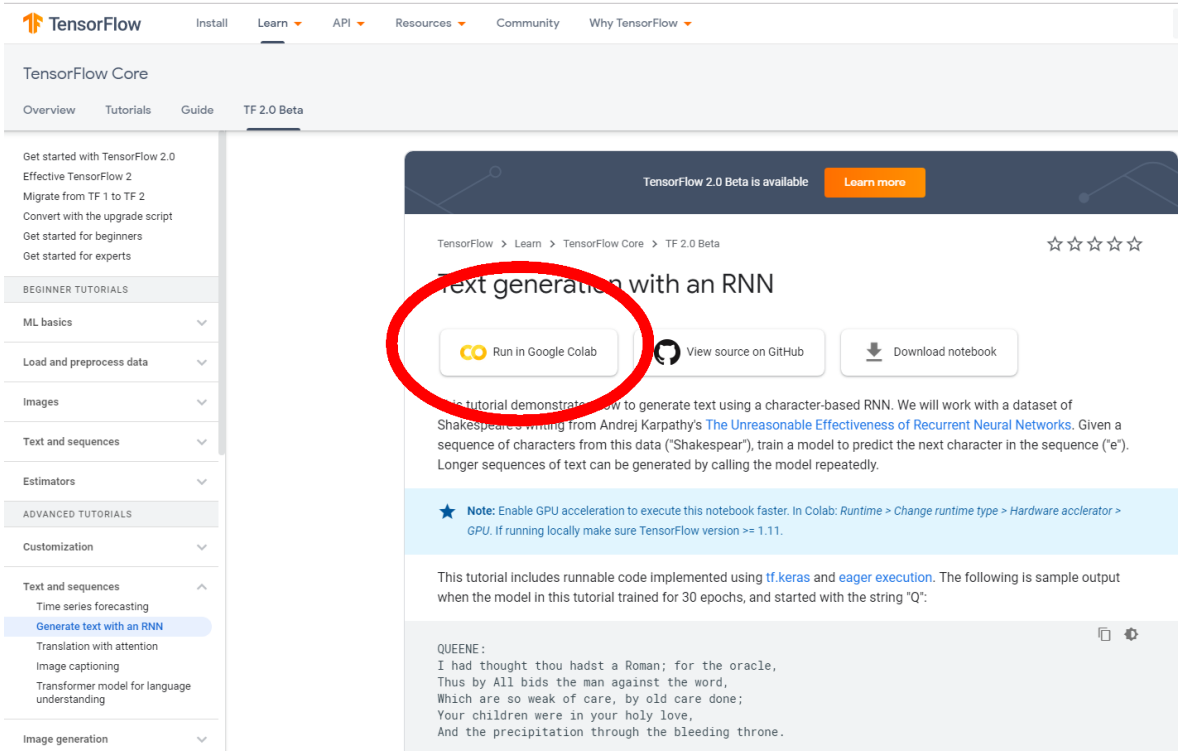
TensorFlow



https://www.tensorflow.org

TensorFlow

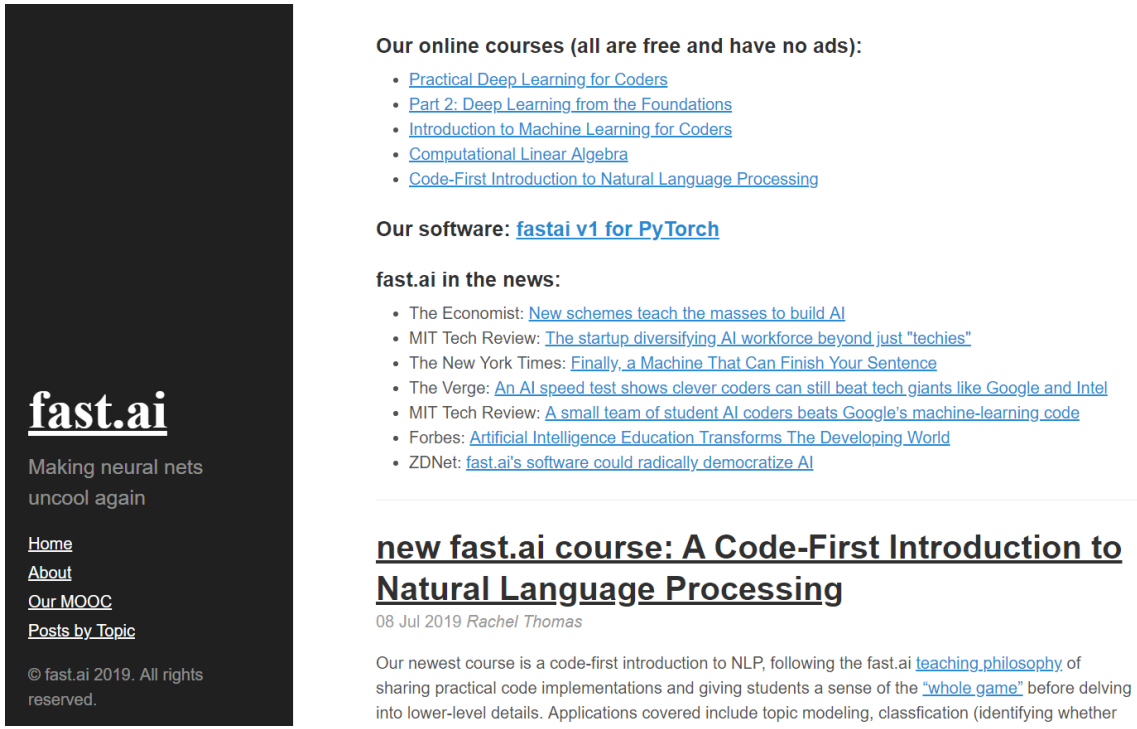
Beta | ADVANCED TUTORIALS | Text and sequences | Generate text with an RNN



Run in Google Colab (Caderno colaborativo): mistura texto explicativo com código que você pode ir executando na nuvem

Fast.ai

Deep Learning para todos: cursos simultâneos presencial/on-line, lições em vídeo, cadernos colaborativos detalhados



fast.ai

Making neural nets uncool again

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Our online courses (all are free and have no ads):

- Practical Deep Learning for Coders
- Part 2: Deep Learning from the Foundations
- Introduction to Machine Learning for Coders
- Computational Linear Algebra
- Code-First Introduction to Natural Language Processing

Our software: fastai v1 for PyTorch

fast.ai in the news:

- The Economist: New schemes teach the masses to build AI
- MIT Tech Review: The startup diversifying AI workforce beyond just "techies"
- The New York Times: Finally, a Machine That Can Finish Your Sentence
- The Verge: An AI speed test shows clever coders can still beat tech giants like Google and Intel
- MIT Tech Review: A small team of student AI coders beats Google's machine-learning code
- Forbes: Artificial Intelligence Education Transforms The Developing World
- ZDNet: fast.ai's software could radically democratize AI

new fast.ai course: A Code-First Introduction to Natural Language Processing

08 Jul 2019 *Rachel Thomas*

Our newest course is a code-first introduction to NLP, following the fast.ai teaching philosophy of sharing practical code implementations and giving students a sense of the "whole game" before delving into lower-level details. Applications covered include topic modeling, classfication (identifying whether

`https://www.fast.ai`

Obrigado!

Cópia desta apresentação:

`www.ic.uncamp.br/~meidanis/research/`