



TensorFlow and Art

TensorFlow 与艺术

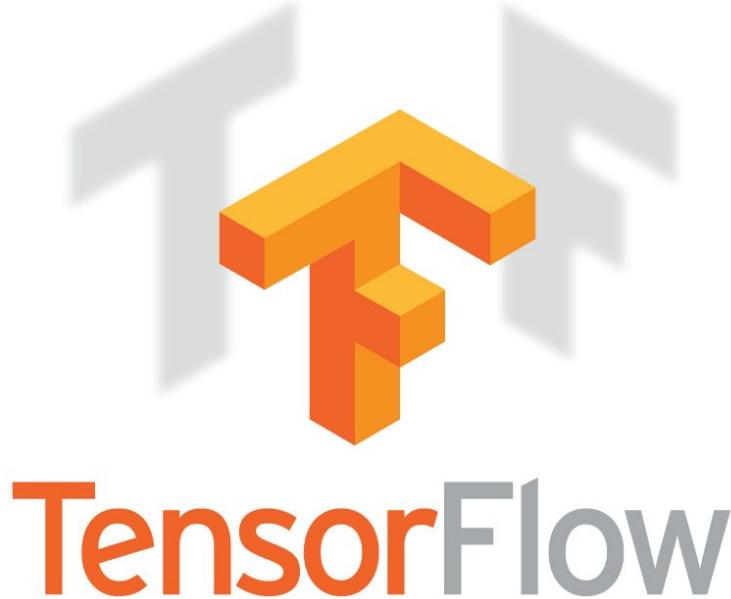
Shanghai, December 2016



Josh Gordon
@random_forests



Wolff Dobson
@greenexecutive



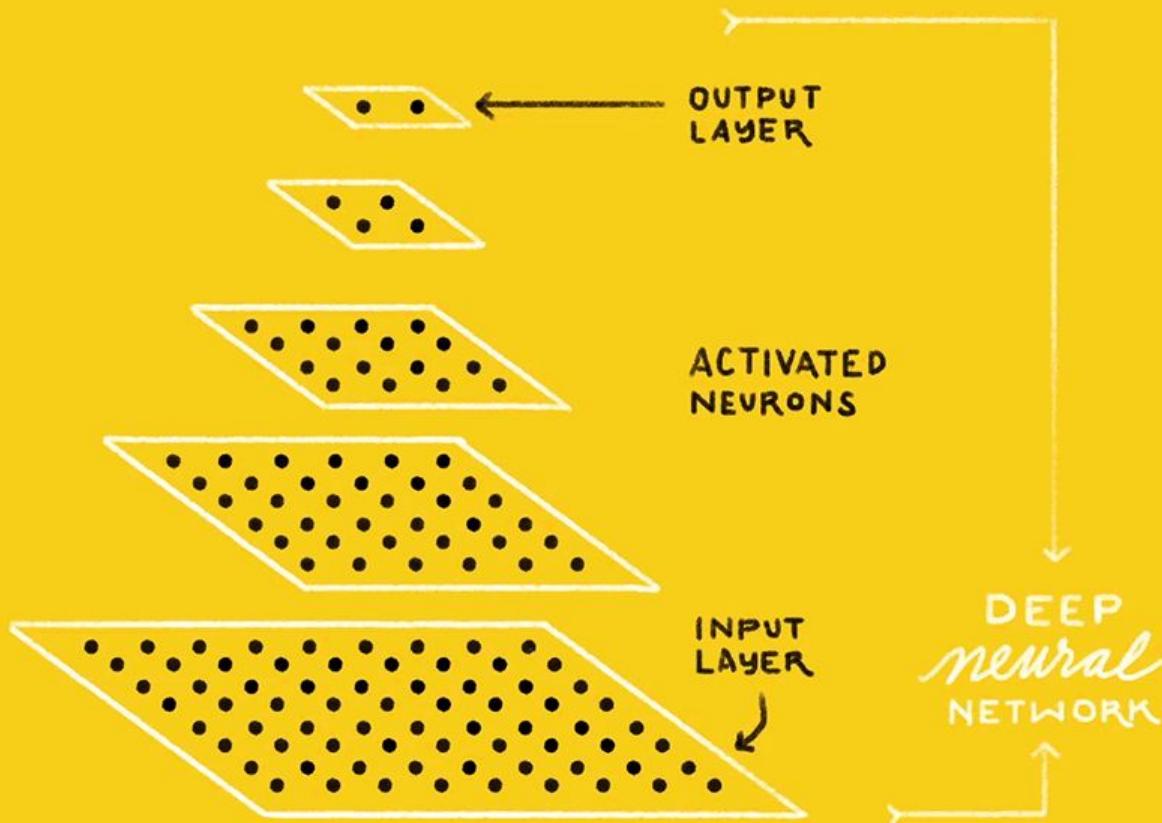
- Fast, flexible, and scalable open-source machine learning library
快速, 灵活, 可扩展的开源机器学习库
- One system for research and production
一个系统用于研究和生产
- Runs on CPU, GPU, TPU, and Mobile
在CPU, GPU, TPU和手机上运行
- Apache 2.0 license
Apache 2.0 许可协议

<https://research.googleblog.com/2016/11/celebrating-tensorflows-first-year.html>

IS THIS A
CAT or DOG?



CAT DOG



Deep Learning 深度学习

Current state of the art in: 当前技术水平在：

Image: *classification, captioning* 图像：分类，字幕

Language: *translation, parsing, summarization* 语言：翻译，解析概括

Speech: *recognition, generation* 语音：识别，生产

Games: *AlphaGo, Atari* 游戏：*AlphaGo, Atari*

And much more. 以及更多。

Reproducible Research

Music <https://magenta.tensorflow.org/2016/11/09/tuning-recurrent-networks-with-reinforcement-learning/>

WaveNet <https://deepmind.com/blog/wavenet-generative-model-raw-audio/>

Translation <https://research.googleblog.com/2016/09/a-neural-network-for-machine.html>

Summarization <https://research.googleblog.com/2016/08/text-summarization-with-tensorflow.html>

Show and Tell <https://research.googleblog.com/2016/09/show-and-tell-image-captioning-open.html>

Inception <https://research.googleblog.com/2016/08/improving-inception-and-image.html>

Parsey McParseface <https://research.googleblog.com/2016/05/announcing-syntaxnet-worlds-most.html>

Images 图像



Inception (模型名)



An [Alaskan Malamute](#) ([left](#)) and a [Siberian Husky](#) ([right](#)). Images from Wikipedia.

<https://research.googleblog.com/2016/08/improving-inception-and-image.html>

Show and Tell 展示说明



<https://research.googleblog.com/2016/09/show-and-tell-image-captioning-open.html>



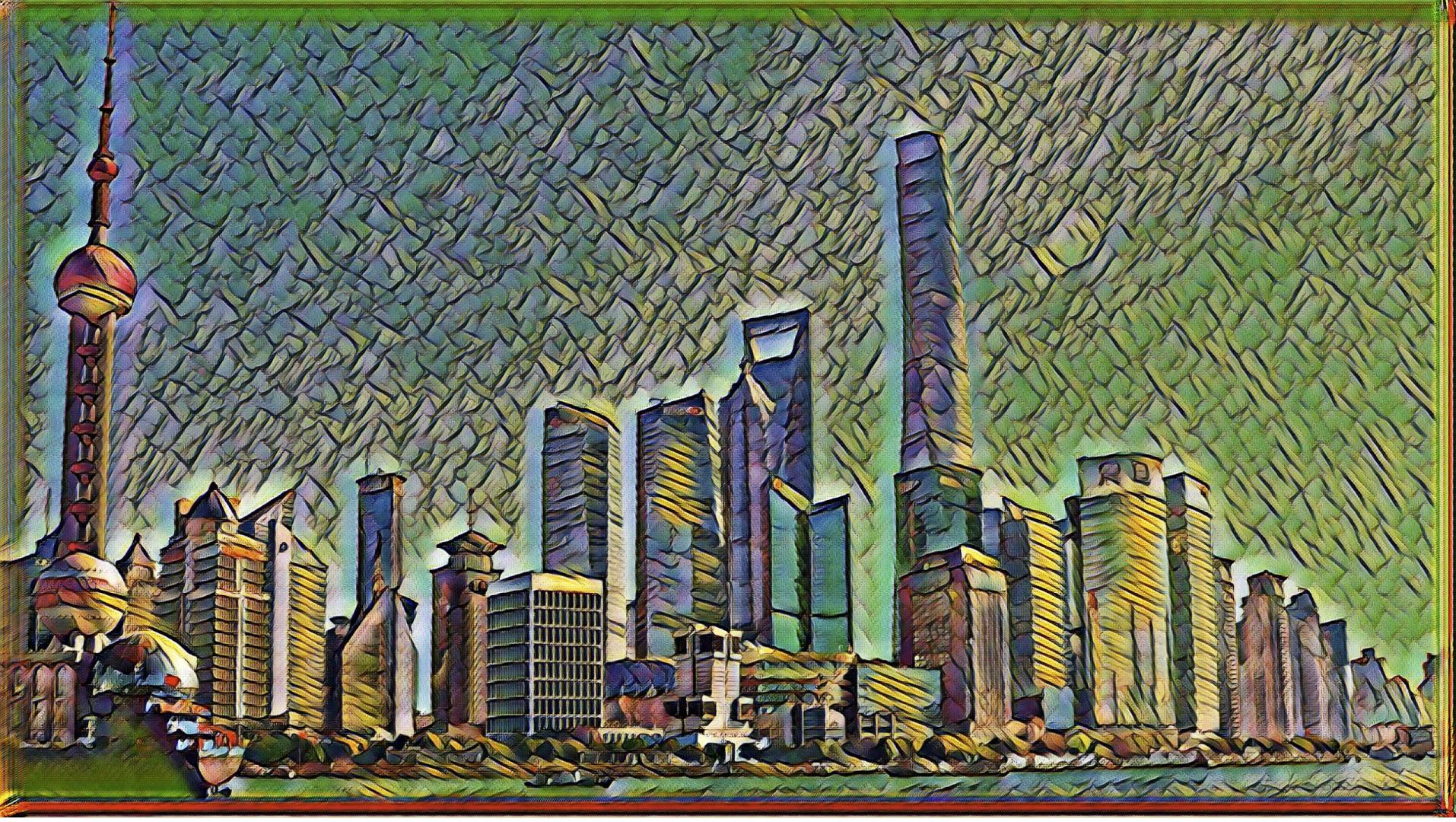
Create your own artwork
创造你自己的艺术作品

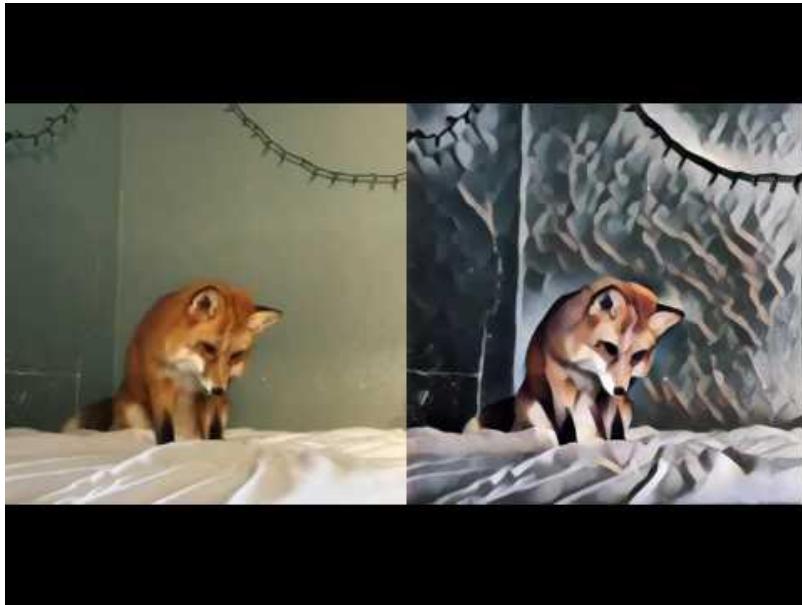


Image source - [Wikimedia Commons](#)









<https://github.com/lengstrom/fast-style-transfer/>

<https://research.googleblog.com/2016/10/supercharging-style-transfer.html>

Style Transfer

风格转换

goo.gl/M5hiYY

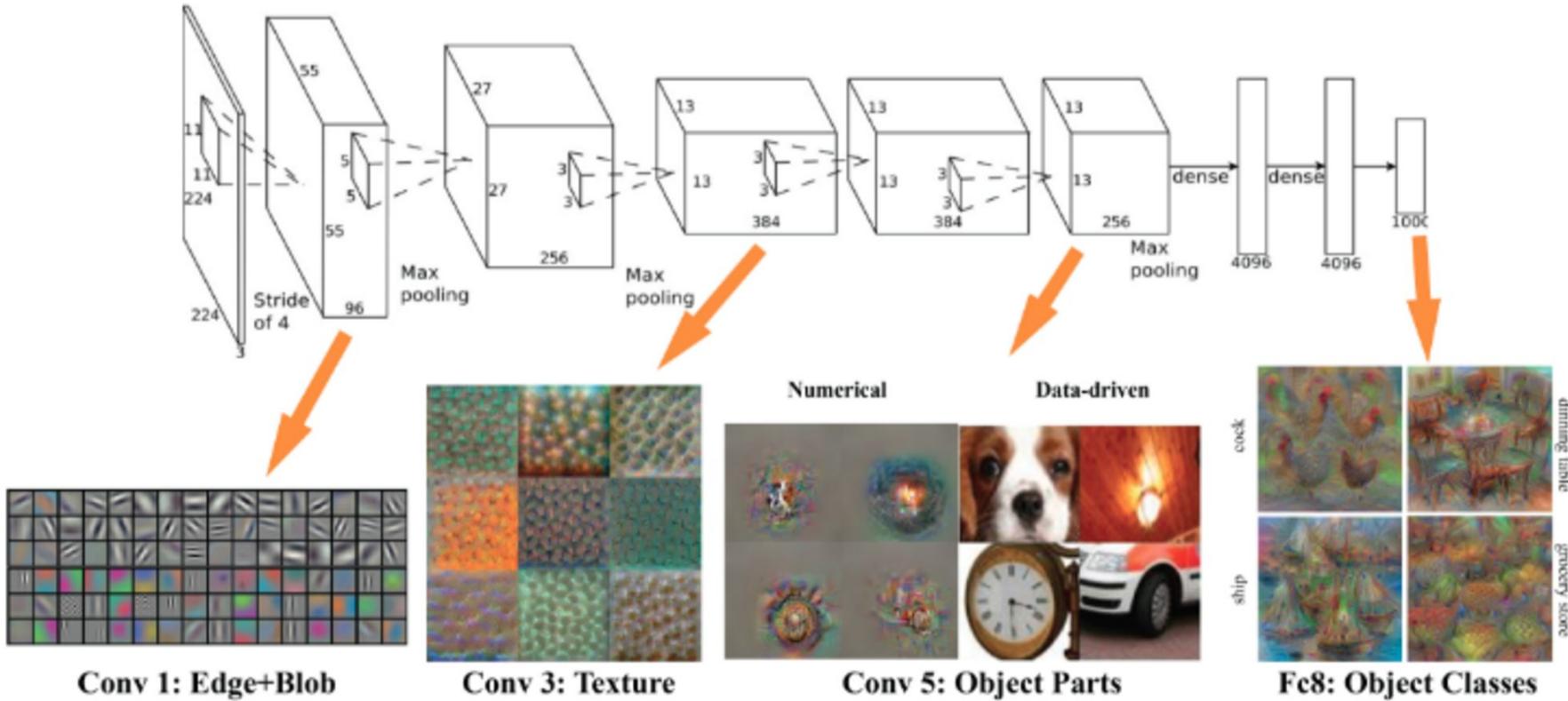
Fast Style Transfer

快速风格转换

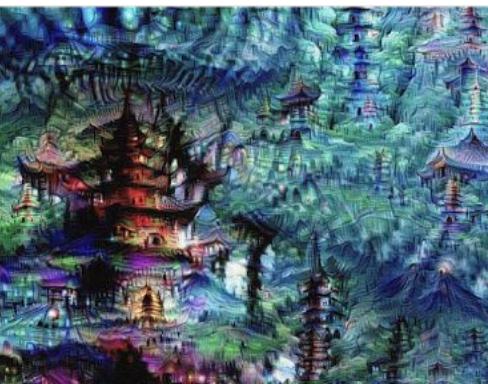
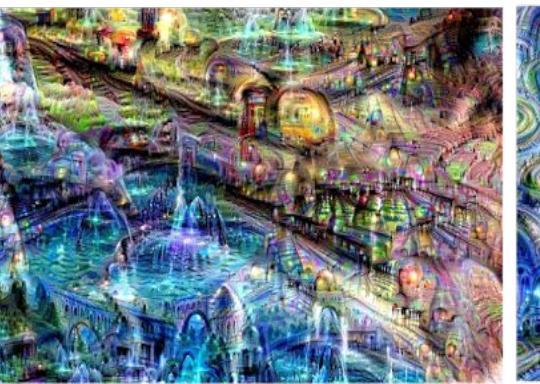
goo.gl/owF2z9

<https://github.com/lengstrom/fast-style-transfer>

<https://research.googleblog.com/2016/10/powering-up-style-transfer.html>



From: [A Matlab Plugin to Visualize Neurons from Deep Models](#), Donglai Wei et. al.





<https://www.youtube.com/watch?v=DgPaCWJL7XI>

<https://research.googleblog.com/2015/06/inceptionism-going-deeper-into-neural.html>



goo.gl/1kBXyO



ColorNet

Grayscale

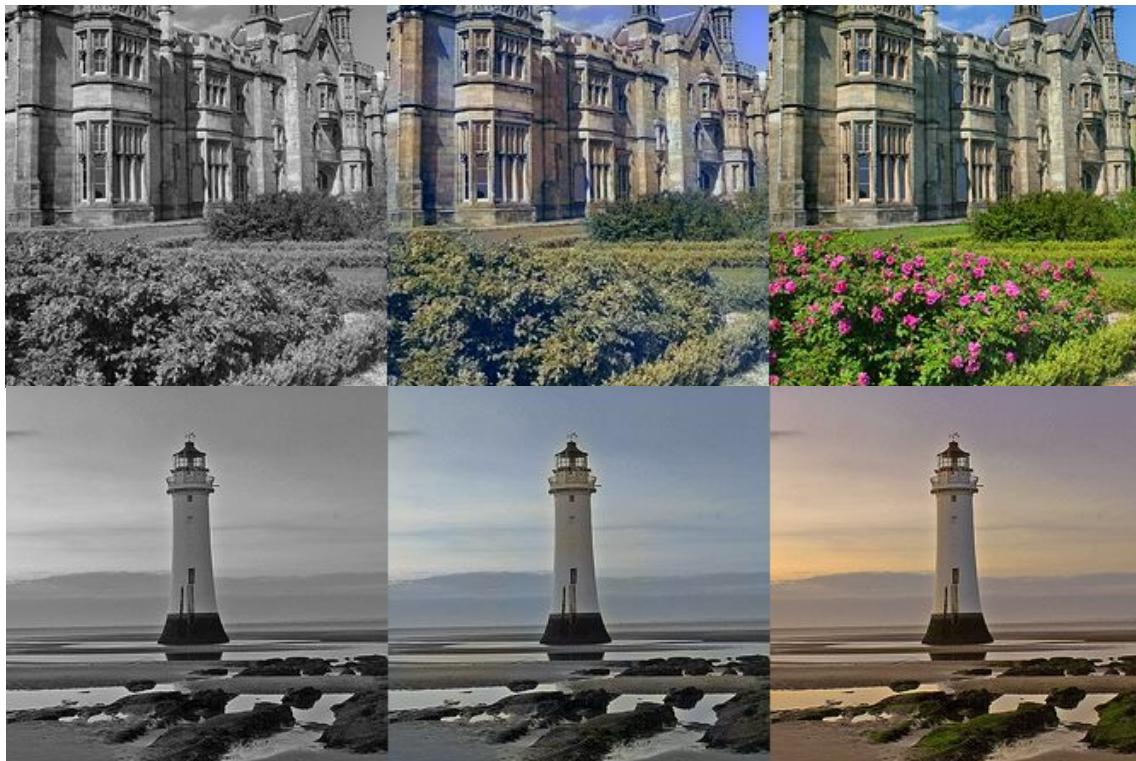
Prediction

Ground Truth

灰度图

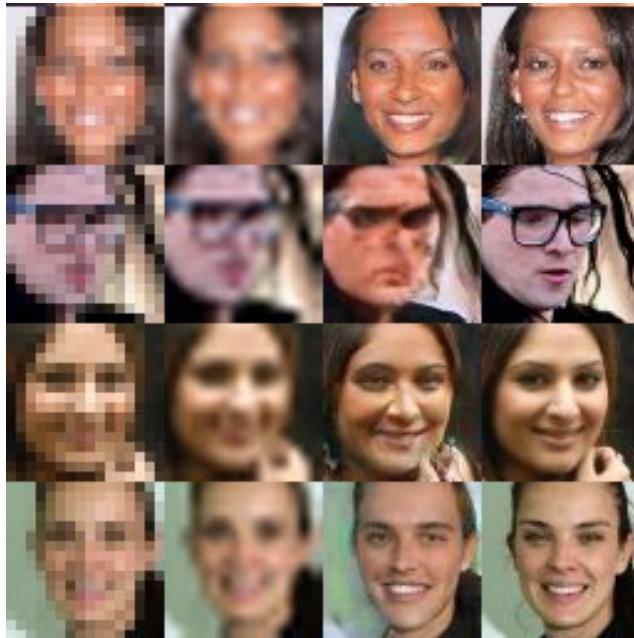
预测

地面实况



<https://github.com/pavelgonchar/colornet>

Image Super-Resolution 超级图片分辨率



<https://github.com/david-gpu/srez>

Open source code from Google and many others

Fast Style Transfer <https://github.com/lengstrom/fast-style-transfer/>

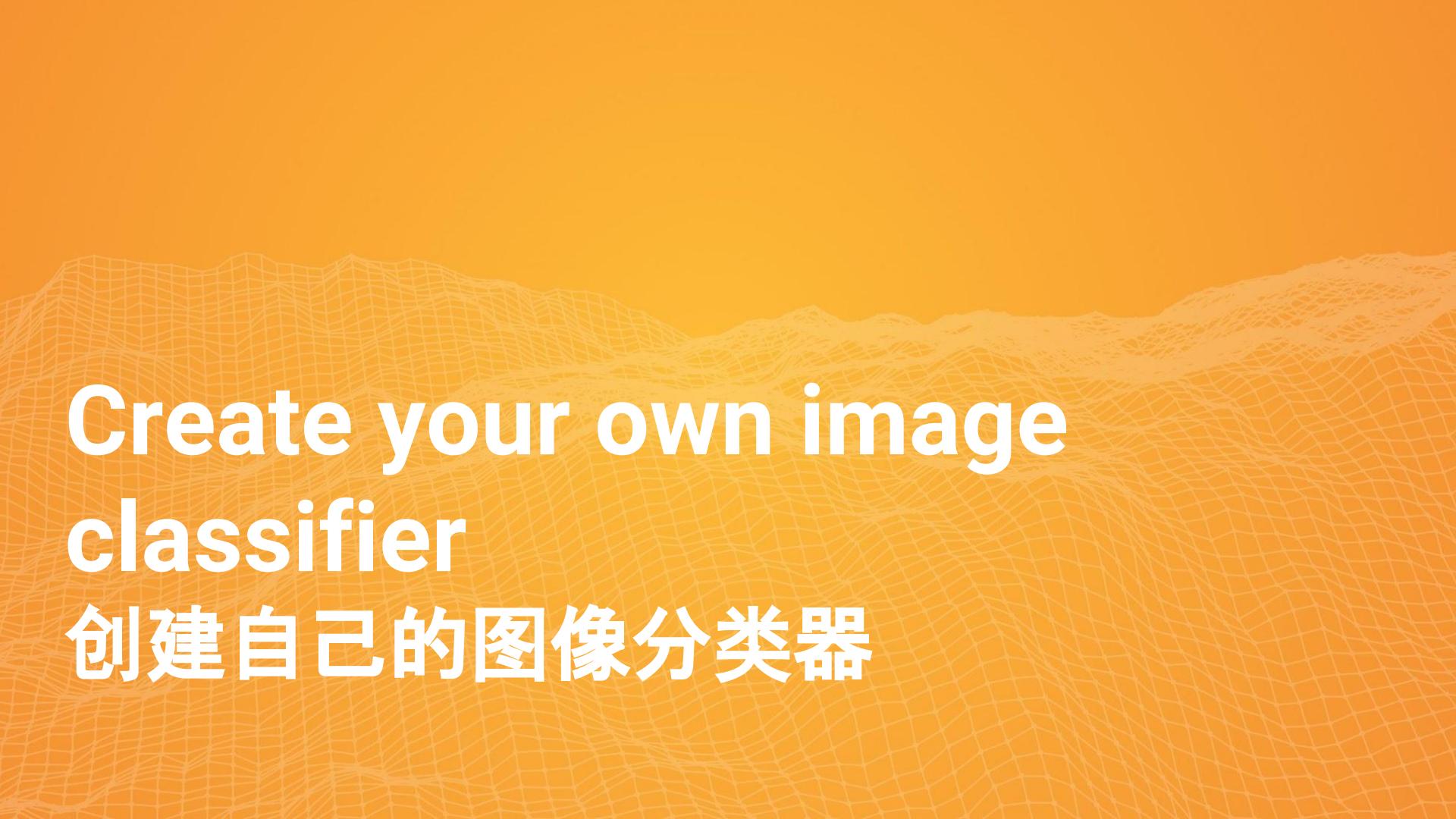
Colornet <https://github.com/pavelgonchar/colornet>

Super Resolution <https://github.com/david-gpu/srez>

TTS <https://github.com/ibab/tensorflow-wavenet>

Speech Recognition <https://github.com/buriburisuri/speech-to-text-wavenet>

Many more <https://github.com/jtoy/awesome-tensorflow>



Create your own image
classifier
创建自己的图像分类器

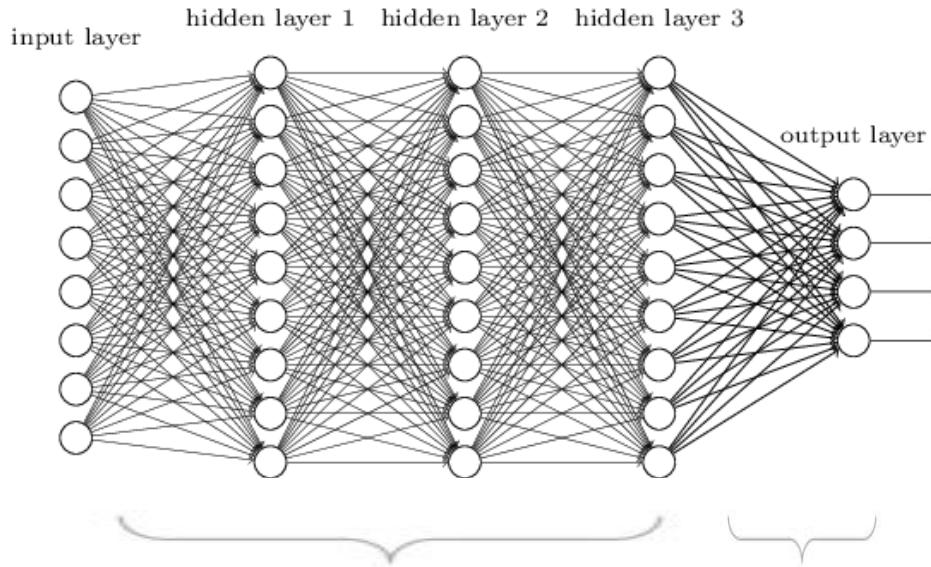
goo.gl/xGsB9d



Claude Monet - Bouquet of Sunflowers
Images from the Metropolitan Museum of Art (with permission)

For more: [@random_forests](https://twitter.com/random_forests)

Transfer Learning 迁移学习



Most of the network is unchanged
大部分网络是不变的

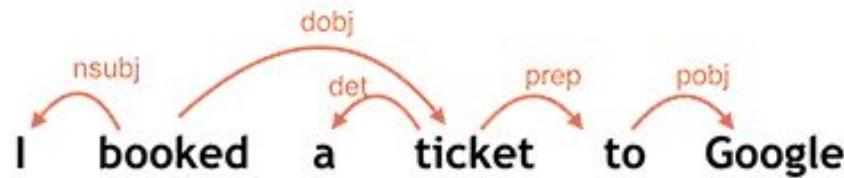
Only the last layer of weights
and the outputs are updated
仅有最后一层的权重和输出被更新

Text
文字

Parsey McParseface

依存句法分析

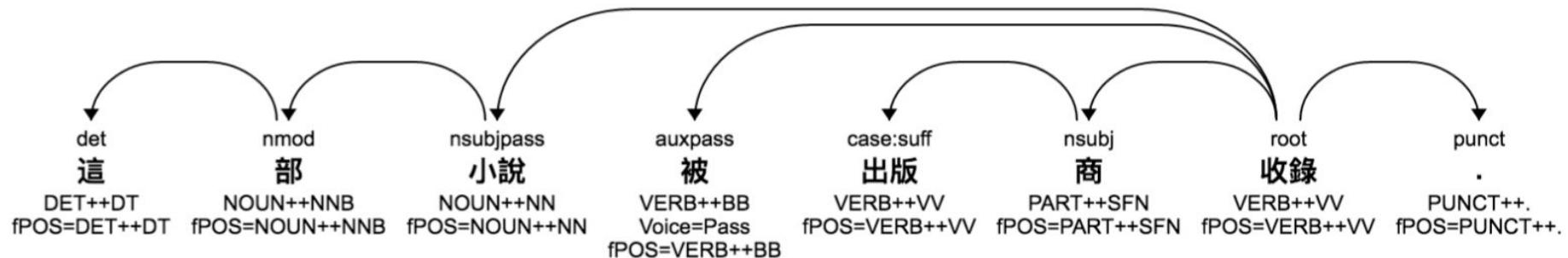
Dependency Parsing



我 订了 一张 票 去 Google

Meet Parsey's Cousins: Syntax for 40 languages

這部小說被出版商收錄。



Text Summarization 文本摘要

Original text

源文本

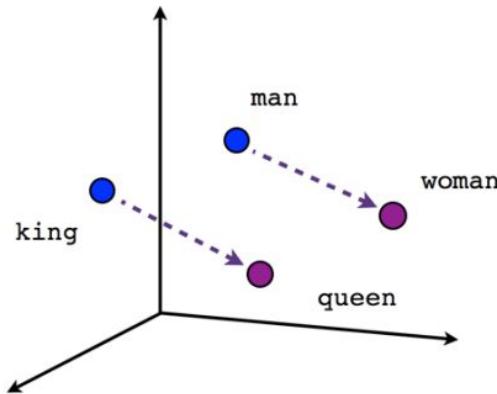
- Alice and Bob took the train to visit the zoo. They saw a **baby giraffe, a lion, and a flock of colorful tropical birds.**
- Alice 和 Bob 乘火车参观动物园。他们看到一头小长颈鹿，一只狮子和一群五颜六色的热带鸟

Abstractive summary

摘要

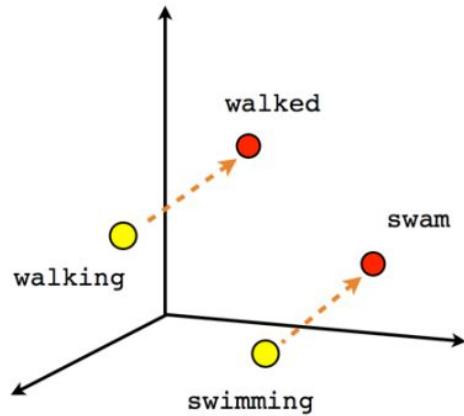
- Alice and Bob visited the zoo and saw **animals and birds.**
- Alice 和 Bob 访问了动物园，看到动物和鸟类。

Word Embeddings 文本嵌入



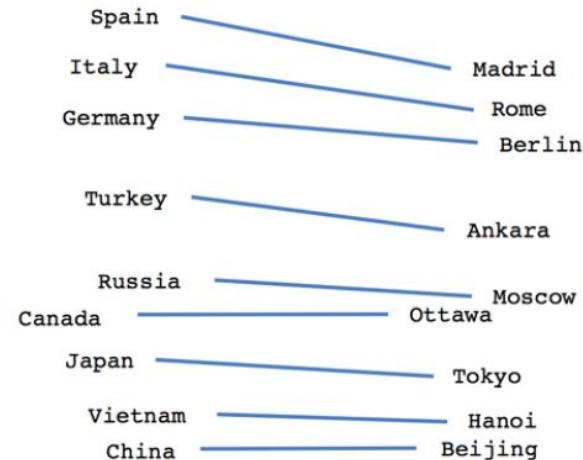
Male-Female

男性 – 女性



Verb tense

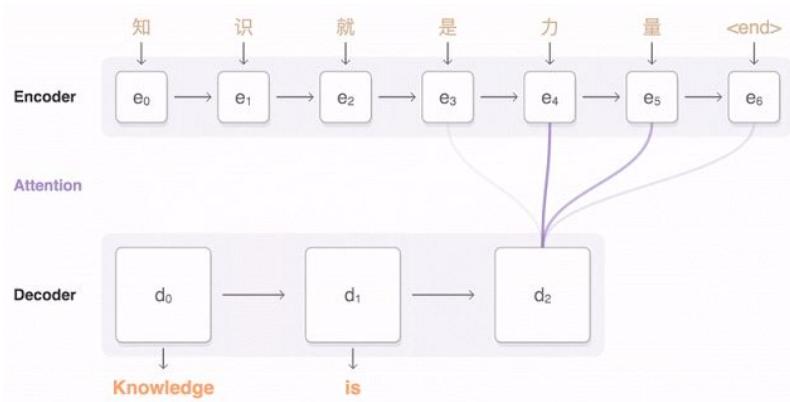
词汇时态



Country-Capital

国家 – 首都

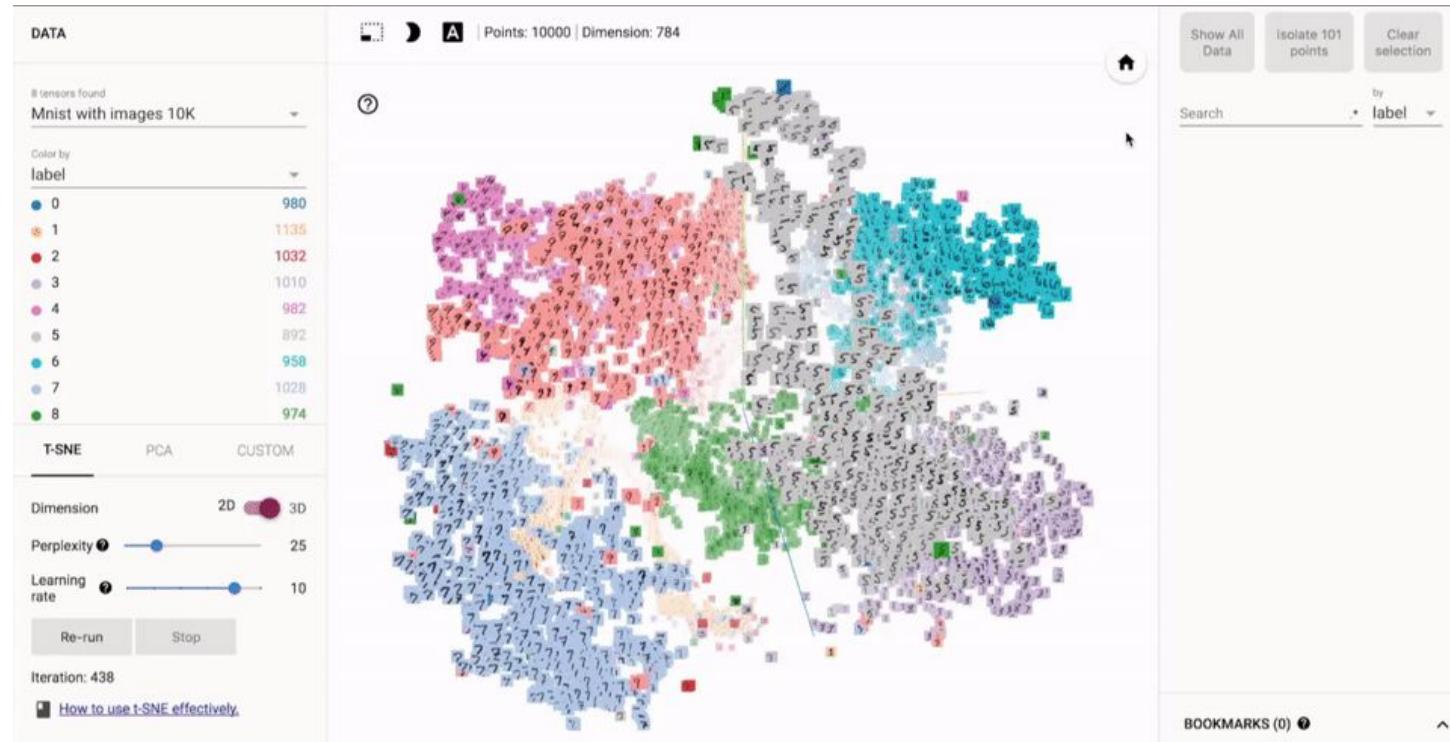
Translation 翻译



Chinese->English	100年前，预测引力波的爱因斯坦或许都无法想象人类可以直接观测到引力波。	100 years ago, the prediction of Einstein's gravitational waves probably can not imagine humans can directly observe gravitational waves.	100 years ago, Einstein predicted gravitational waves may not be able to imagine humans can directly observe the gravitational waves.	100 years ago, Einstein who predicted gravitational waves may not be able to imagine that humans can directly observe the gravitational waves.
------------------	--------------------------------------	---	---	--

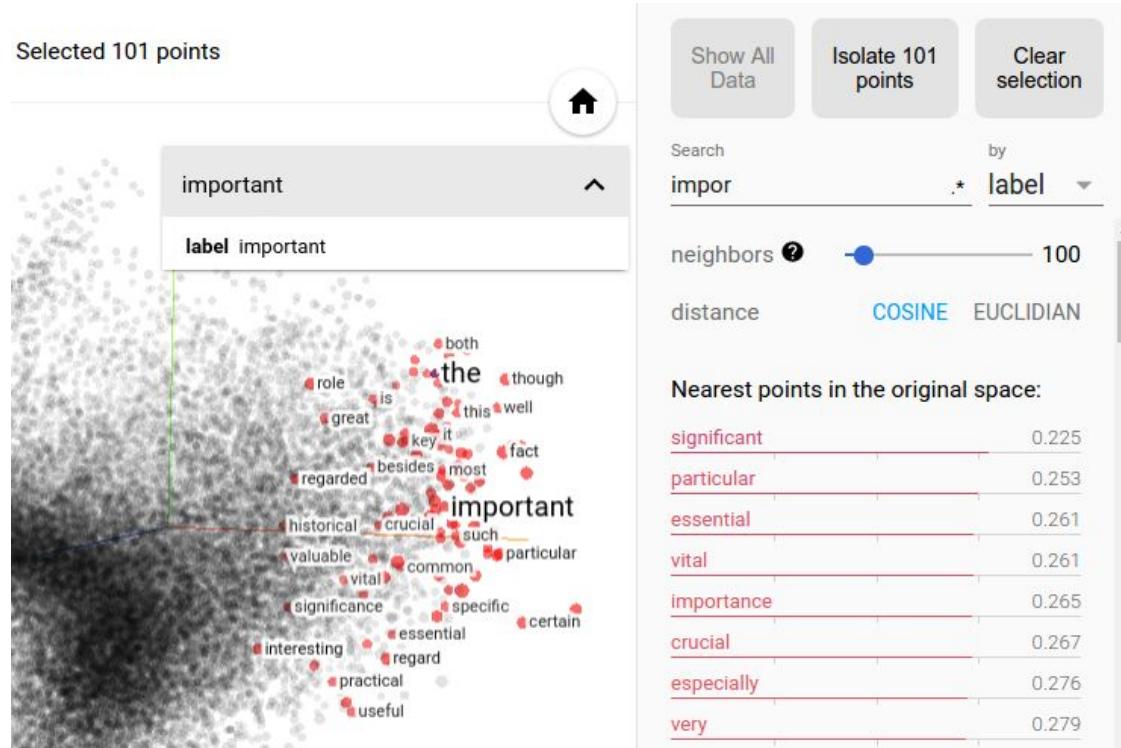
<https://research.googleblog.com/2016/09/a-neural-network-for-machine.html>

TensorBoard



https://www.tensorflow.org/versions/r0.12/how_tos/embedding_viz/index.html

TensorBoard

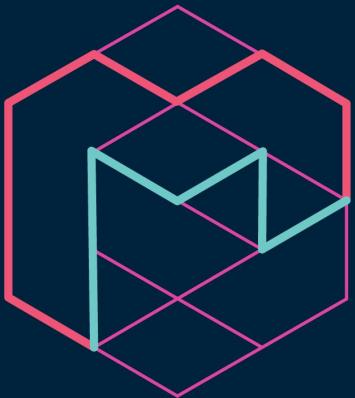


https://www.tensorflow.org/versions/r0.12/how_tos/embedding_viz/index.html

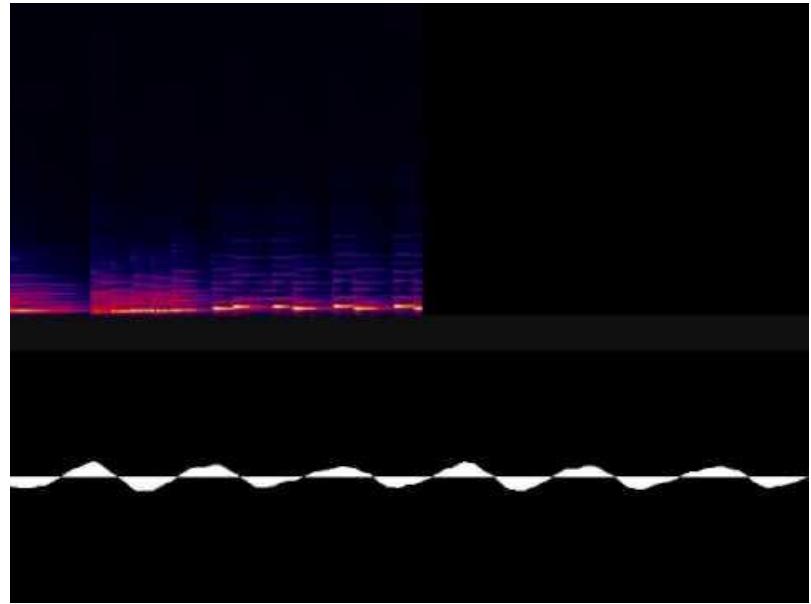
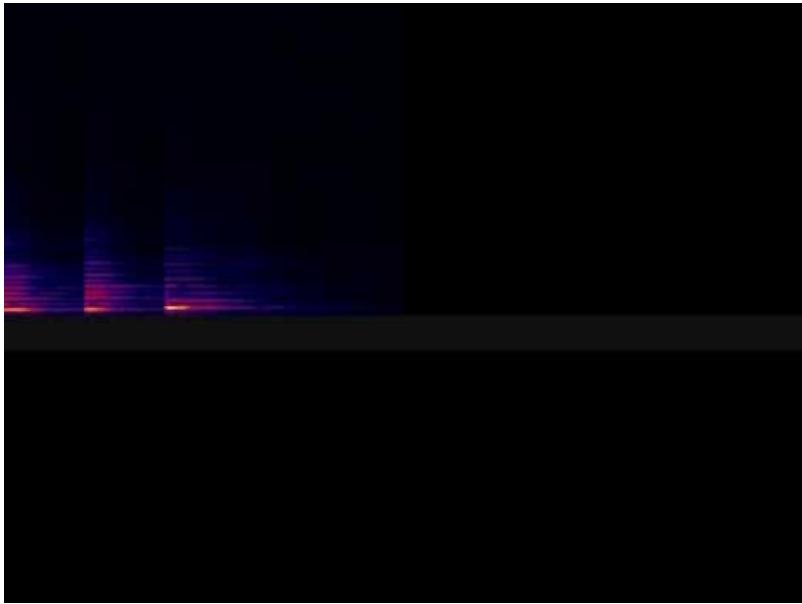
Sound

声音





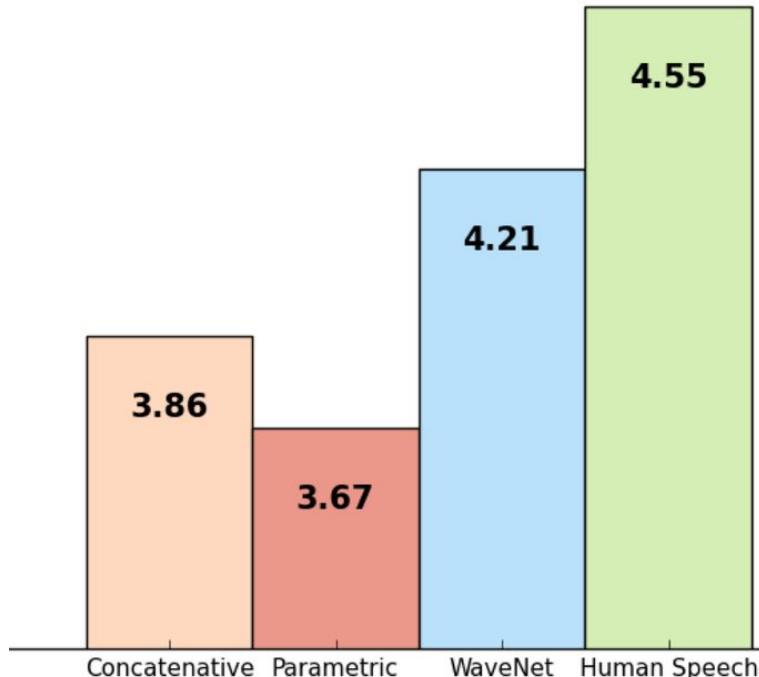
MAGENTA



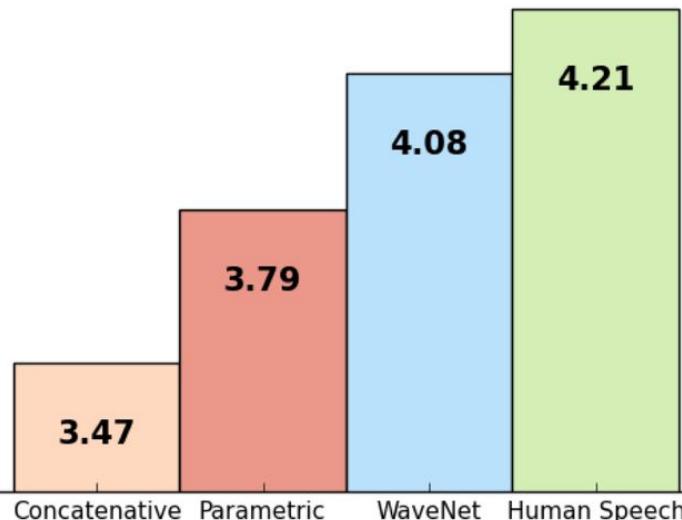
<https://magenta.tensorflow.org/2016/11/09/tuning-recurrent-networks-with-reinforcement-learning/>

WaveNet

US English



Mandarin Chinese



<https://deepmind.com/blog/wavenet-generative-model-raw-audio/>

Generating Speech and Music 生成语音和音乐

[English – Parametric 英文 – 参数化](#)

[English – Concatenative 英文 - 拼接](#)

[English – WaveNet 英文 - WaveNet](#)

[Mandarin – Parametric 汉语 - 参数化](#)

[Mandarin – Concatenative 汉语 – 拼接](#)

[Mandarin – WaveNet 汉语 - WaveNet](#)

[Bonus - on hold 福利时间 – 听一段铃声](#)

<https://deepmind.com/blog/wavenet-generative-model-raw-audio/>

<https://magenta.tensorflow.org/2016/11/09/tuning-recurrent-networks-with-reinforcement-learning/>

References 参考文献

WaveNet

<https://deepmind.com/blog/wavenet-generative-model-raw-audio/>

A TensorFlow implementation of DeepMind's WaveNet paper

<https://github.com/ibab/tensorflow-wavenet>

Speech-to-Text-WaveNet : End-to-end sentence level English speech
recognition based on DeepMind's WaveNet and TensorFlow

<https://github.com/buriburisuri/speech-to-text-wavenet>

Games
游戏





BBC News Sport Weather iPlayer TV Radio More Search

NEWS

Find local news

Home UK World Business Politics Tech Science Health Education Entertainment & Arts More

Technology

Google achieves AI 'breakthrough' at Go

An artificial intelligence program developed by Google beats Europe's top player at the ancient Chinese game of Go, about a decade earlier than expected.

© 27 January 2016 | Technology

How did they do it?
What is the game Go?

Facebook trains AI to beat humans at Go



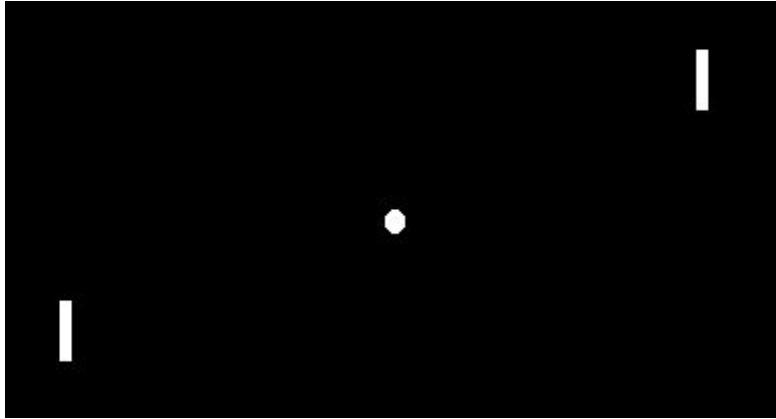
Google's AI just cracked the game that supposedly no computer could beat

By Mike Murphy | January 27, 2016



Going up. (Reuters/Kiyoshi Ota)

Computers have slowly started to encroach on activities we previously believed only the brilliantly sophisticated human brain could handle. IBM's Deep Blue supercomputer beat Grand Master Garry Kasparov at chess in 1997, and in 2011 IBM's Watson beat former human winners at the quiz game *Jeopardy*. But the ancient board game Go has long been one of the major goals of artificial intelligence research. It's understood to be one of the most difficult games for computers to handle due to the sheer number of possible moves a player can make at any given point. Until now, that is.

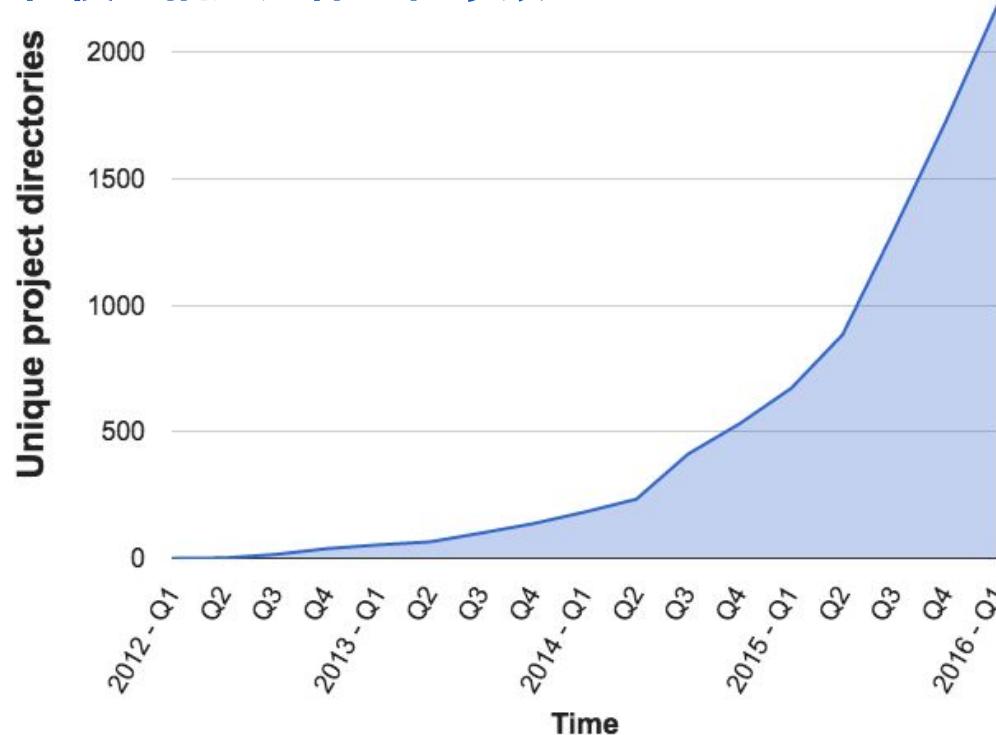


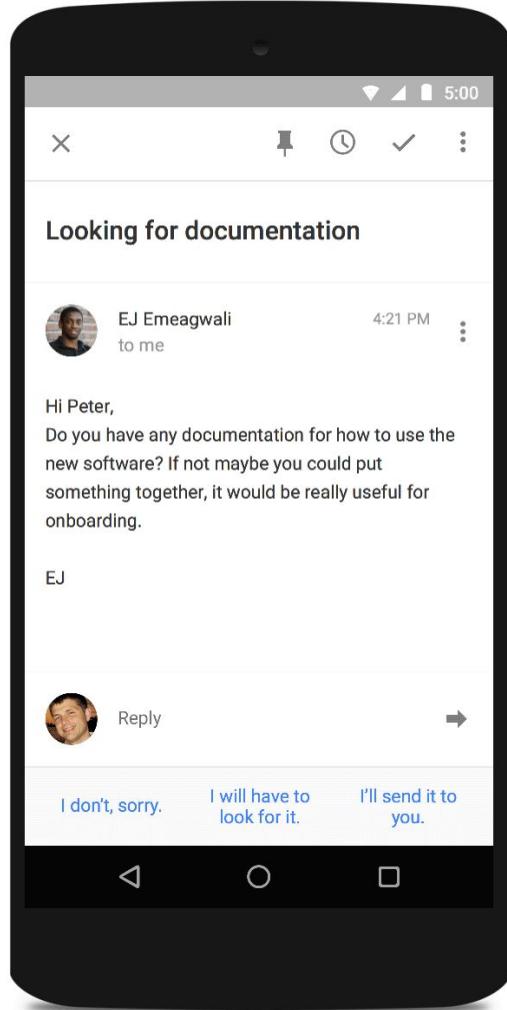
Deep Learning at Google

Google的深度学习

Growing Use of Deep Learning at Google Google 越来越多地使用深度学习

of directories containing model description files
包含模型描述文件的目录数





Smart reply
in Inbox by Gmail
Gmail收件箱中的智能回复

10%

of all responses
sent on mobile

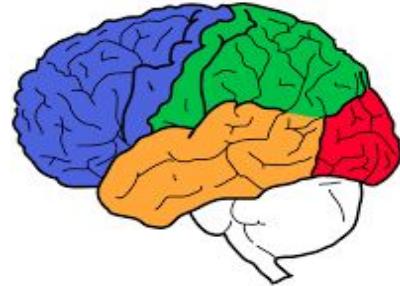
10%的回复由手机发送

In conclusion

“Universal” Machine Learning

“通用”机器学习

语音 Speech
文字 Text
查询 Search
问题 Queries
图像 Images
视频 Videos
标签 Labels
实体 Entities
单词 Words
音频 Audio
特征 Features



语音 Speech
文字 Text
查询 Search
问题 Queries
图像 Images
视频 Videos
标签 Labels
实体 Entities
单词 Words
音频 Audio
特征 Features

Detection of Diabetic Eye Disease

糖尿病眼病的检测



<https://research.googleblog.com/2016/11/deep-learning-for-detection-of-diabetic.html>

Next steps - 免费的学习资源

Tutorials and code

tensorflow.org

Totally new to ML?

Recipes goo.gl/KewA03

Intro to Deep Learning with TensorFlow

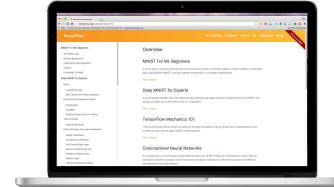
Udacity class goo.gl/iHssl

Stanford's CS231n

cs231n.github.io

Udacity's Machine Learning Nanodegree

goo.gl/ODpXj4



These slides + exercises

goo.gl/nrdsxM

TensorFlow Playground

goo.gl/mXhncM

Chris Olah's blog

Colah.github.io

Michael Nielsen's book

neuralnetworksanddeeplearning.com

Thank you and have fun!

谢谢你们，玩得开心！



Josh Gordon
[@random_forests](https://twitter.com/random_forests)

Questions?

Extras



Progress last year

Release

November 2015

December (0.6)

February (0.7)

April (0.8)

June (0.9)

August (0.10)

October (0.11)

November (0.12)

Milestone

Initial release

Faster on GPUs; Python 3.3+

TensorFlow Serving

Distributed TensorFlow

iOS; Mac GPU

Slim

HDFS; CUDA 8, CuDNN 5

Windows 7, 10, and Server 2016

Cumulative GitHub Stars



