How Can You Get Started with Machine Learning?

Asad Memon

How Can You Get Started with Machine Learning?

Three ways, with varying complexity:

(1) Use a Cloud-based or Mobile API (Vision, Natural Language, etc.)

(2) Use an existing model architecture, and retrain it or fine tune on your dataset

(3) Develop your own machine learning models for new problems

More flexible, but more effort required

Cloud Machine Learning APIs

See, Hear and Understand the world

Google Cloud Platform

Cloud
Vision

Cloud
Natural Language

Cloud
Speech

Cloud
Translate

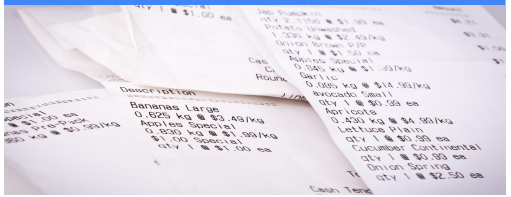
Vision API Demo

Cloud Vision API

Faces
Faces, facial landmarks, emotions

Label
Detect entities from furniture to transportation

OCR
Read and extract text, with support for > 10 languages

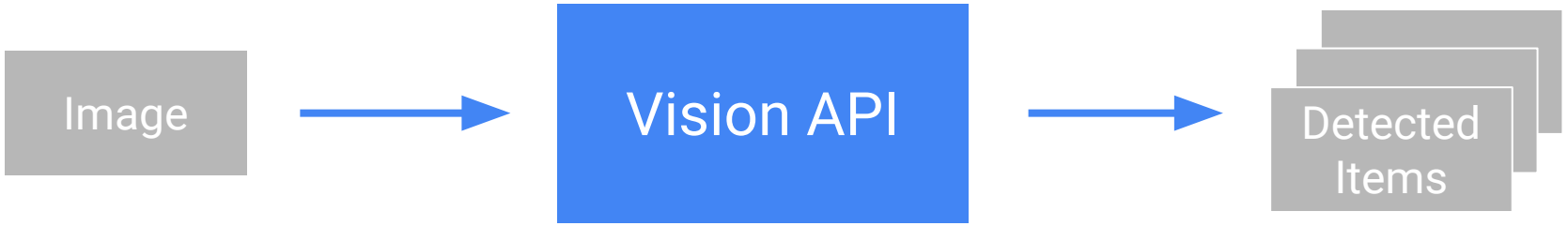


Logos
Identify product logos

Safe Search
Detect explicit content - adult, violent, medical and spoof

Landmarks & Image Properties
Detect landmarks & dominant color of image

API Usage: Detect Objects in an Image



1. Create JSON request with the image or pointer to an image
2. Call the REST API
3. Process the JSON response

Coding Example

Cloud Natural Language API

Syntax Analysis

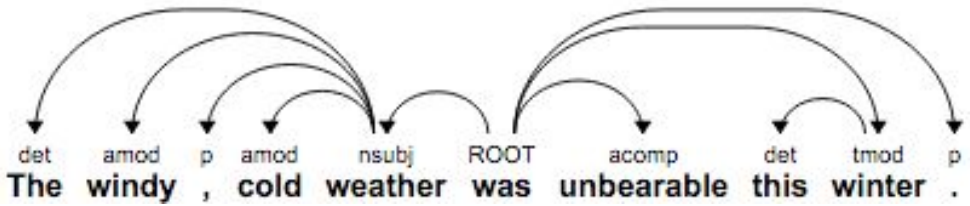
Extract sentence, identify parts of speech and create dependency parse trees for each sentence.

Entity Recognition

Identify entities and label by types such as person, organization, location, events, products and media.

Sentiment Analysis

Understand the overall sentiment of a block of text.



Cloud Speech API

Automatic Speech Recognition

Automatic Speech Recognition (ASR) powered by deep learning neural networking to power your applications like voice search or speech transcription.

Global Vocabulary

Recognizes over 80 languages and variants with an extensive vocabulary.

Streaming Recognition

Returns partial recognition results immediately, as they become available.

Inappropriate Content Filtering

Filter inappropriate content in text results.

Real-time or Buffered Audio Support

Audio input can be captured by an application's microphone or sent from a pre-recorded audio file. Multiple audio file formats are supported, including FLAC, AMR, PCMU and linear-16.

Noisy Audio Handling

Handles noisy audio from many environments without requiring additional noise cancellation.

Integrated API

Audio files can be uploaded in the request and, in future releases, integrated with Google Cloud Storage.

What’s Next?

Codelabs

codelabs.developers.google.com/codelabs/cloud-vision-intro/index.html
codelabs.developers.google.com/codelabs/cloud-speech-intro/index.html
codelabs.developers.google.com/codelabs/cloud-nl-intro/index.html

For Developers

cloud.google.com/vision/
cloud.google.com/speech/
cloud.google.com/natural-language/
cloud.google.com/translate/

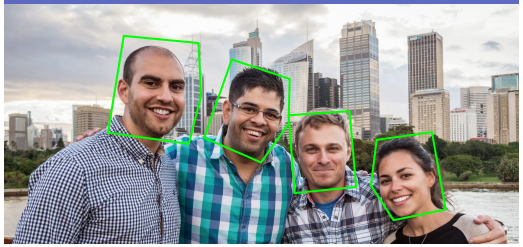
Stack Overflow

Mobile Vision API

Providing on-device vision for applications

Face API

faces, facial landmarks, eyes open, smiling



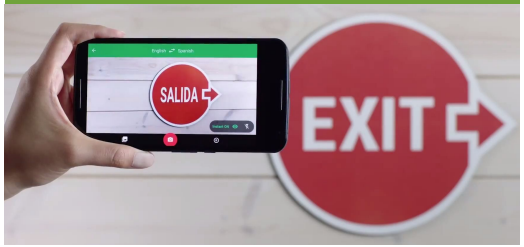
Barcode API

1D and 2D barcodes

Text API

NEW!

Latin-based text / structure



Common Mobile Vision API

Support for fast image and video on-device detection and tracking.

Googly Eyes Android App

1. Create a face detector for facial landmarks (e.g., eyes)

```
FaceDetector detector = new FaceDetector.Builder()
    .setLandmarkType(FaceDetector.ALL_LANDMARKS)
    .build();
```

2. Detect faces in the image

```
SparseArray<Face> faces = detector.detect(image);
```

3. For each face, draw the eyes

```
for (int i = 0; i < faces.size(); ++i) {
  Face face = faces.valueAt(i);
  for (Landmark landmark : face.getLandmarks()) {
    // Draw eyes
```

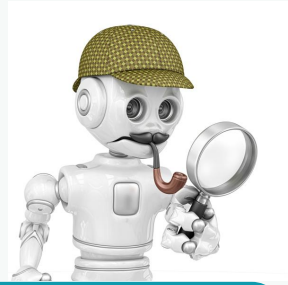
Video credit Google

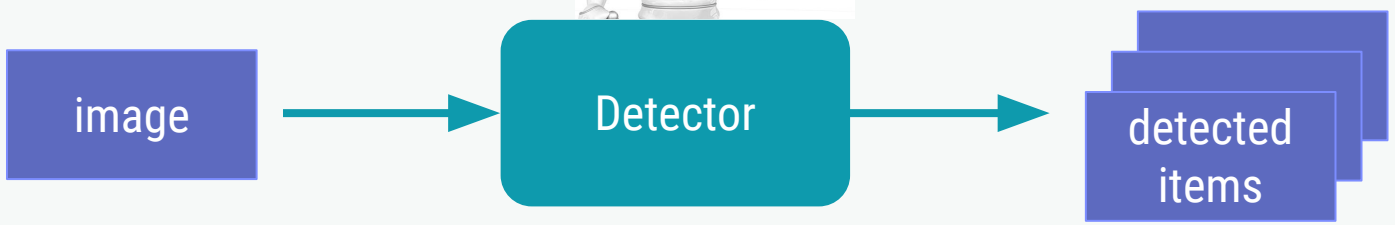
Face API

Photo credit developers.google.com/vision

Google

Easy to use Java API





1. Create a detector object
2. detectedItems = detector.detect(image)

Photo credit developers.google.com/vision

Text Detection

Latin based language
Understand text structure

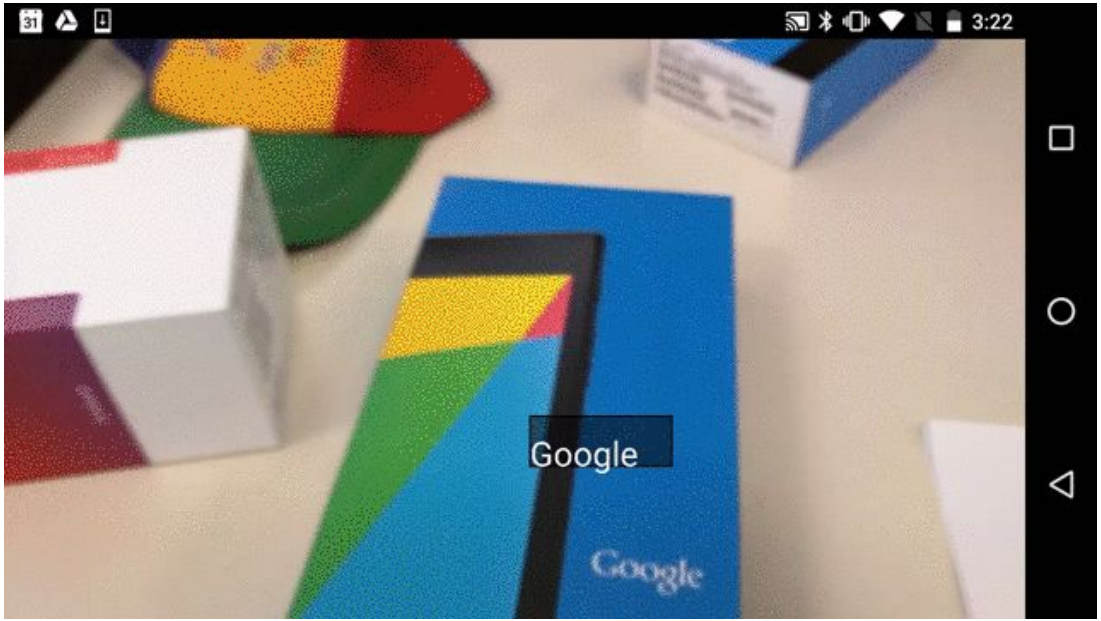
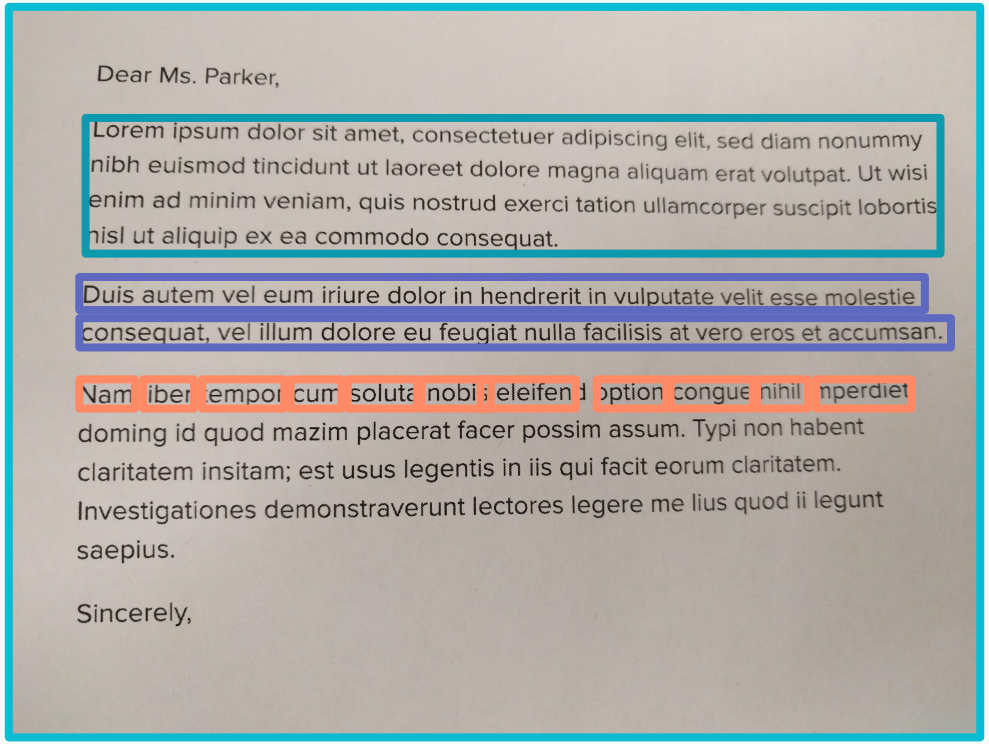
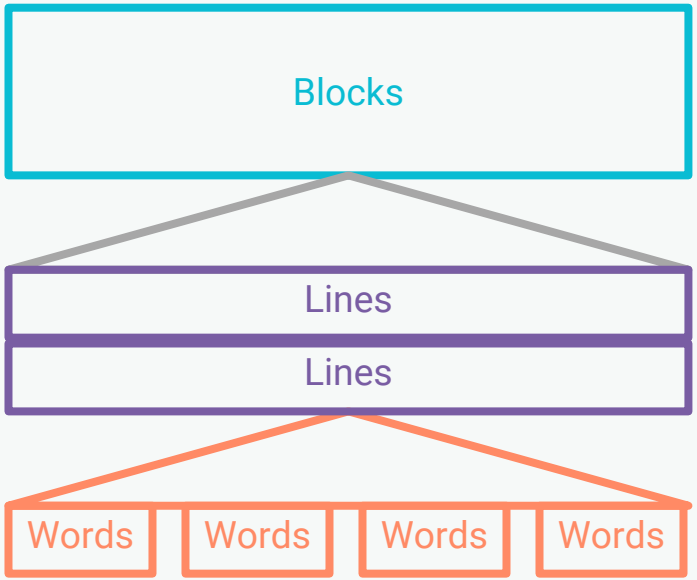


Photo credit Getty Images

Text Structure





Google

Barcode Detection

1D barcodes

- EAN-13/8
- UPC-A/E
- Code-39/93/128
- ITF
- Codabar

2D barcodes

- QR Code
- Data Matrix
- PDF-417
- AZTEC

UPC

DataMatrix

QR Code

PDF 417

Video and image credit Google

Combined Vision & Translation

Mobile Vision: Codelabs and Samples

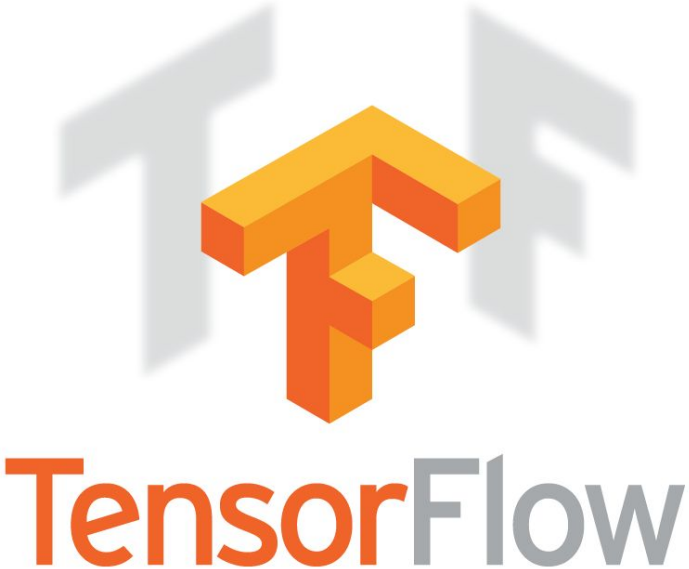
Googly Eyes Code Sample
github.com/googlesamples/android-vision/tree/master/visionSamples/googly-eyes

Codelabs
codelabs.developers.google.com/codelabs/face-detection/
codelabs.developers.google.com/codelabs/mobile-vision-ocr/

Mobile Vision Developers
developers.google.com/vision/

GitHub Code Samples
github.com/googlesamples/android-vision

Stack Overflow
Find and ask questions under the **android-vision** tag.



- **Open source** Machine Learning library
- Especially useful for **Deep Learning**
- For research **and** production
- **Apache 2.0** license

Hello World

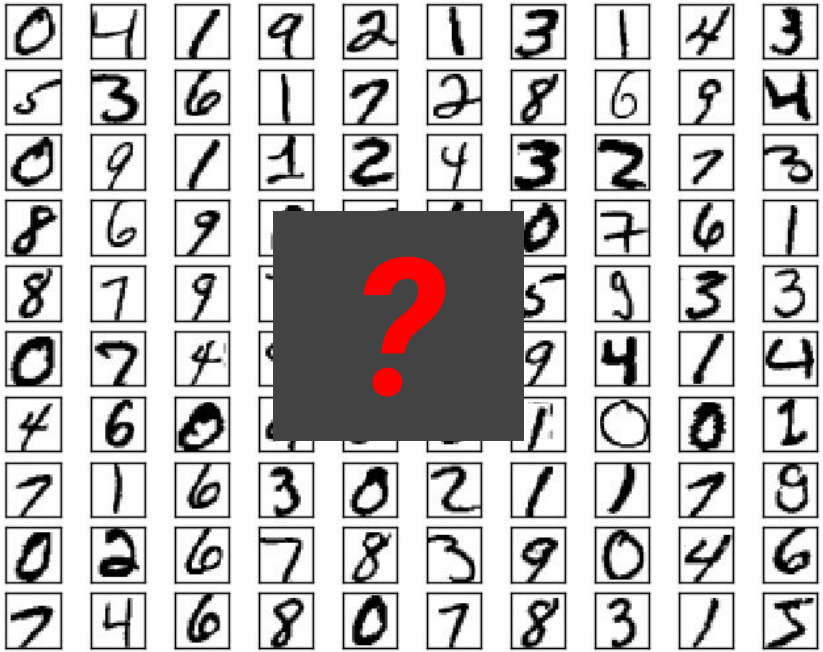
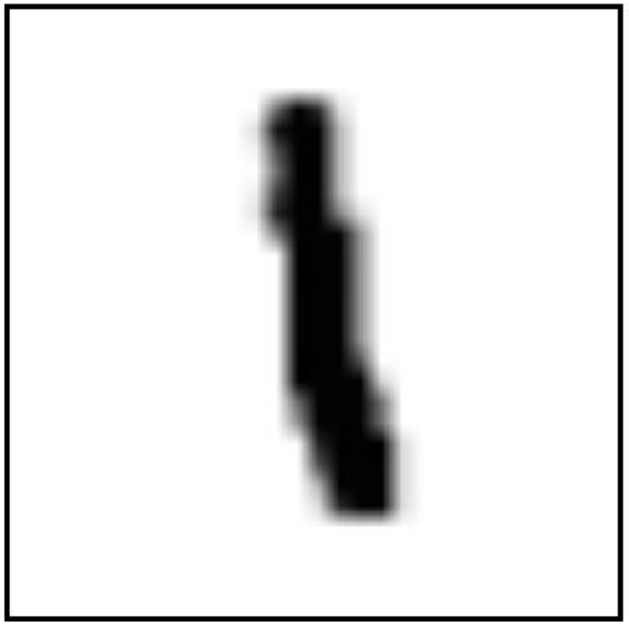


Image from https://github.com/mnielsen/neural-networks-and-deep-learning

What we see



What the computer “sees”

$$\approx$$

$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & .6 & .8 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & .7 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & .7 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & .5 & 1 & .4 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & .4 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & .4 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & .7 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & .9 & 1 & .1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & .3 & 1 & .1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

IS THIS A

CAT or DOG?

CAT DOG

OUTPUT LAYER

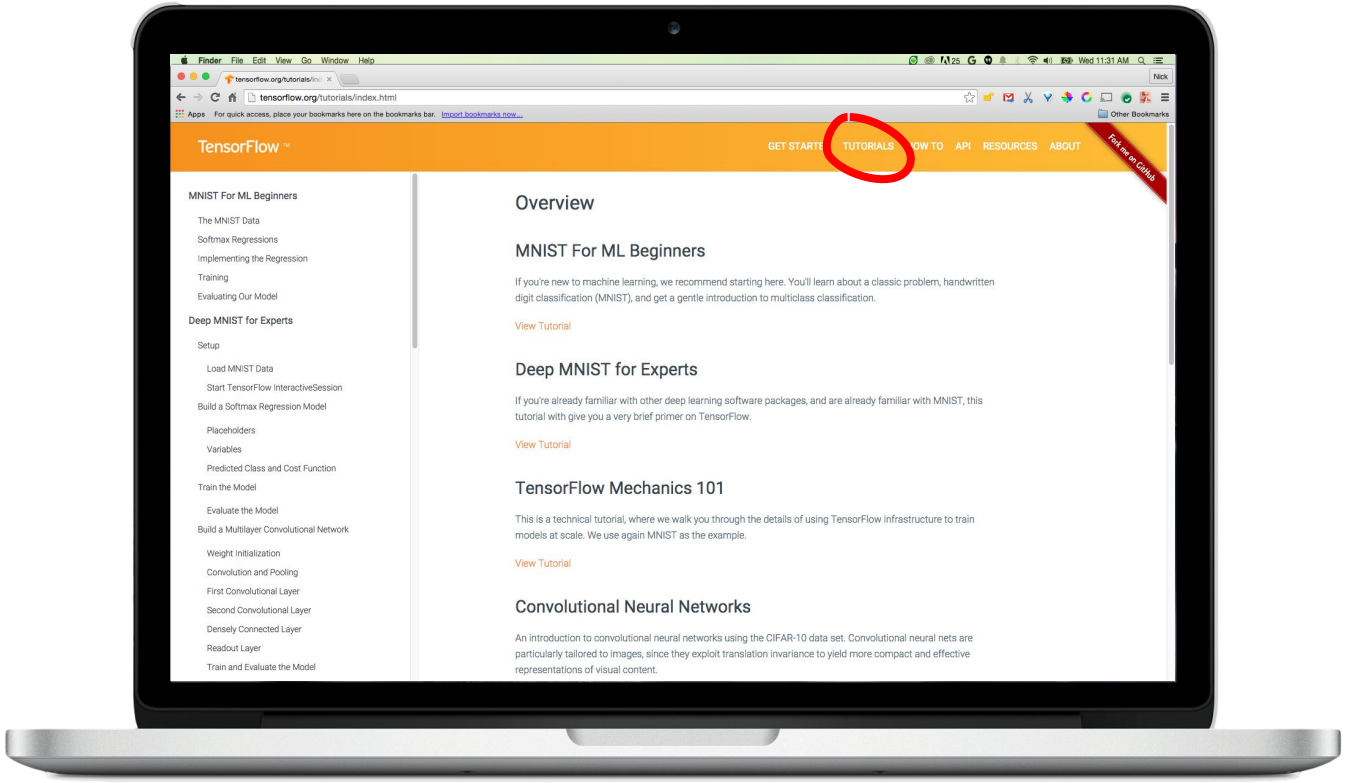
ACTIVATED NEURONS

INPUT LAYER

DEEP *neural* NETWORK

TensorFlow Playground Demo

Lots of tutorials at tensorflow.org



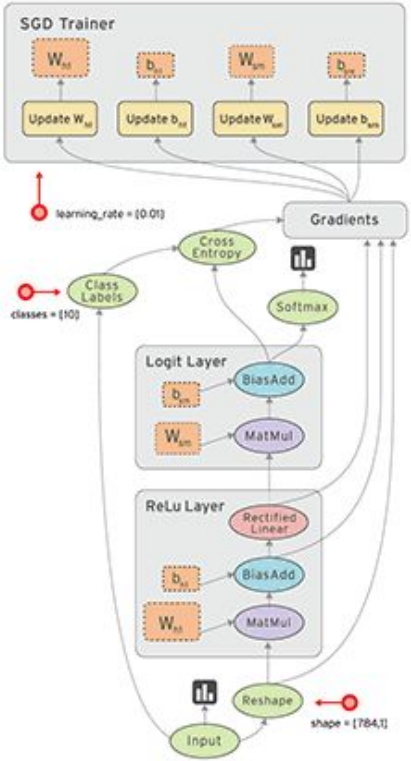
A multidimensional array.

A graph of operations.

Data Flow Graphs

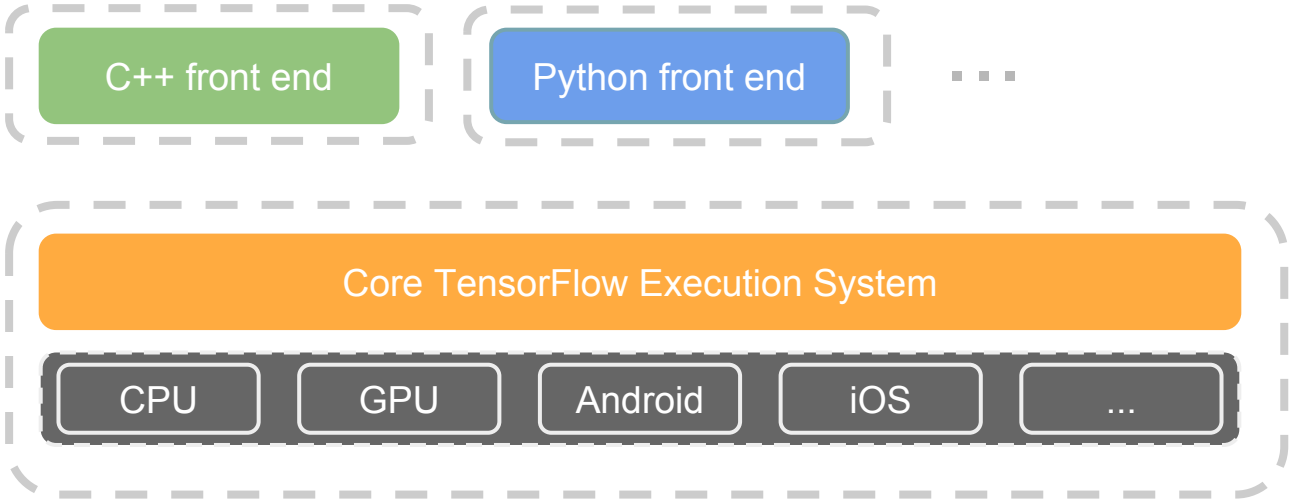
Computation is defined as a directed acyclic graph (DAG) to optimize an objective function

- Graph is defined in high-level language (Python)
- Graph is compiled and optimized
- Graph is executed (in parts or fully) on available low level devices (CPU, GPU)
- Data (tensors) flow through the graph
- TensorFlow can compute gradients automatically



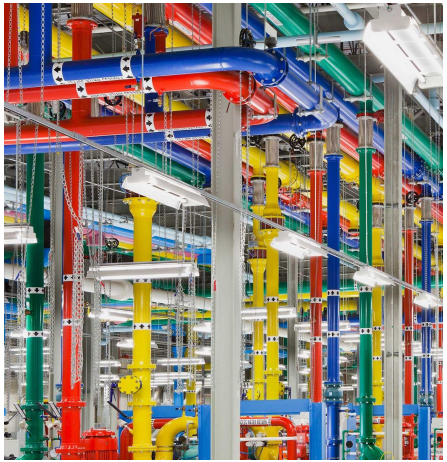
Architecture

- Core in C++
- Different front ends
  - Python and C++ today, community may add more



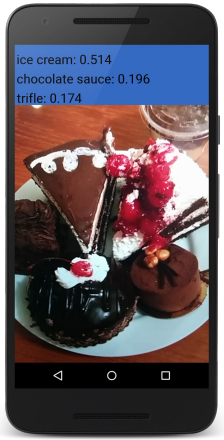
Portable & Scalable

Your laptop

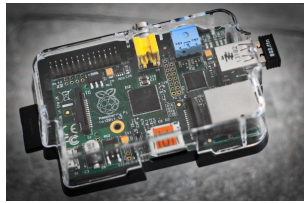


Datacenters

Android



iOS



Raspberry Pi

Examples of Machine Learning

Recognizing images with Inception

spotted salamander

fire salamander

retriever

https://research.googleblog.com/2016/03/train-your-own-image-classifier-with.html

AlphaGo

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

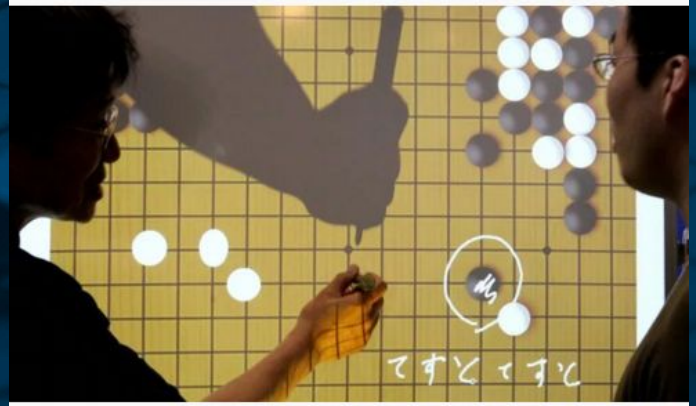
How did they do it?

What is the game Go?

Facebook trains AI to beat humans at Go

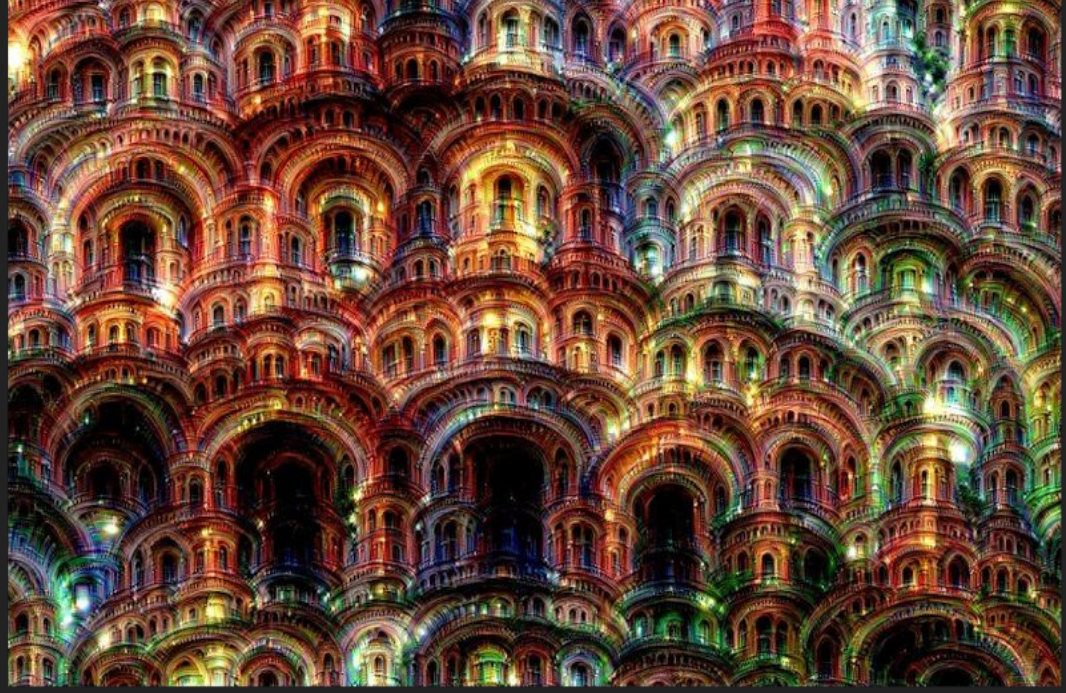
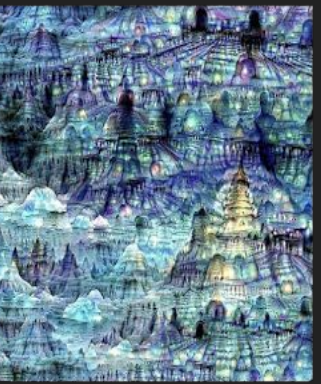
Google's AI just cracked the game that supposedly no computer could beat

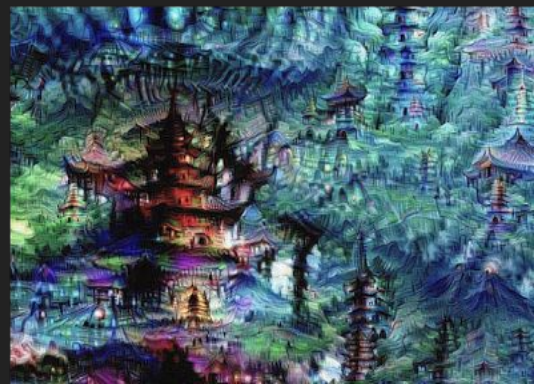
By Mike Murphy | January 27, 2016



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.

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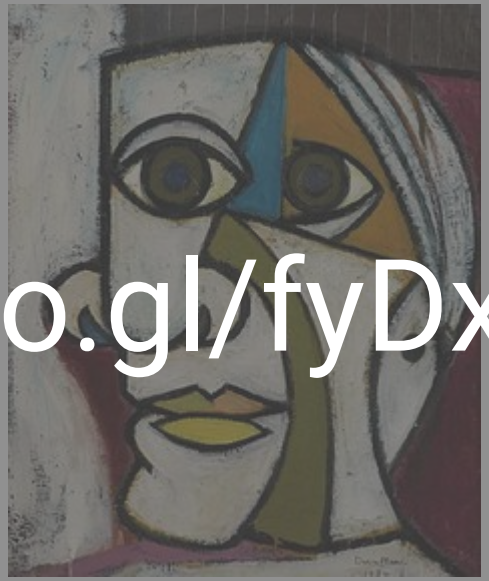
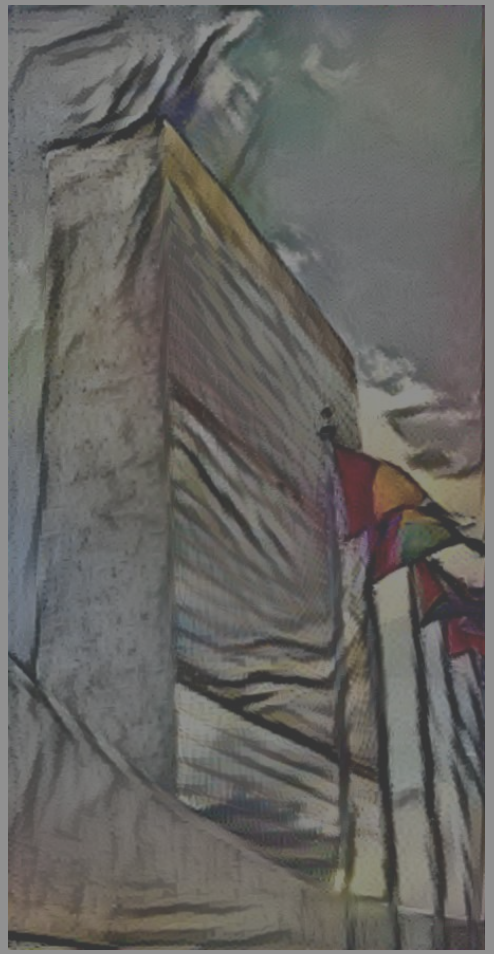
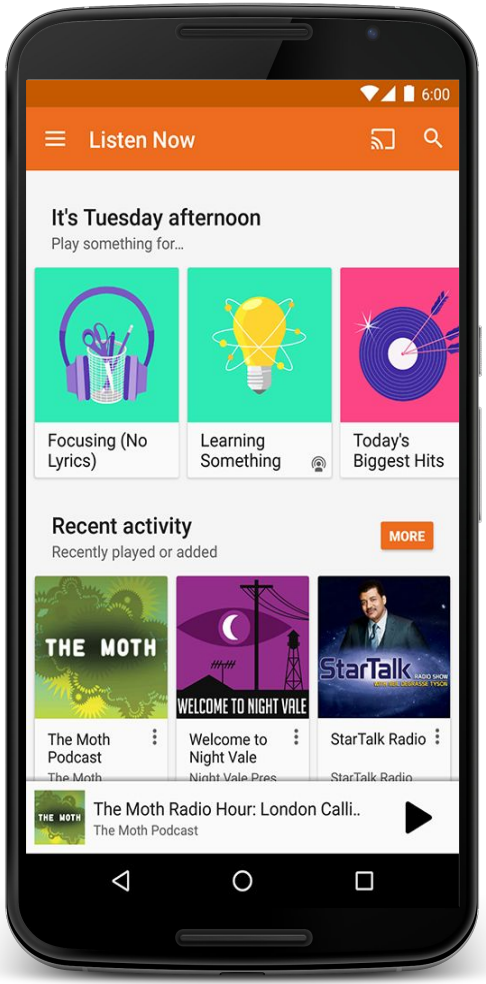
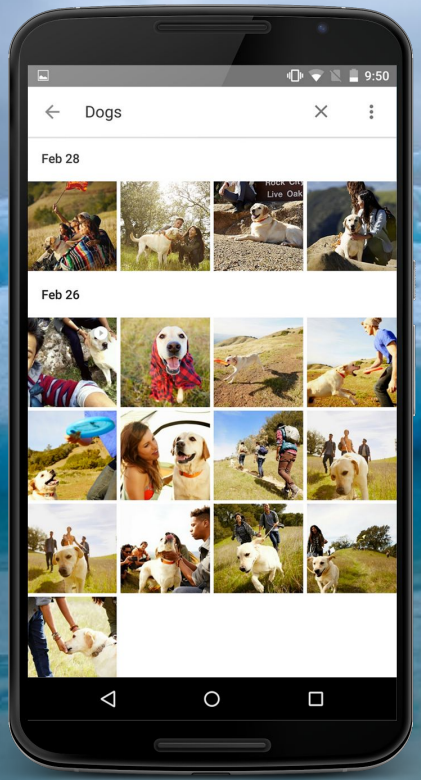
goo.gl/fyDxhC



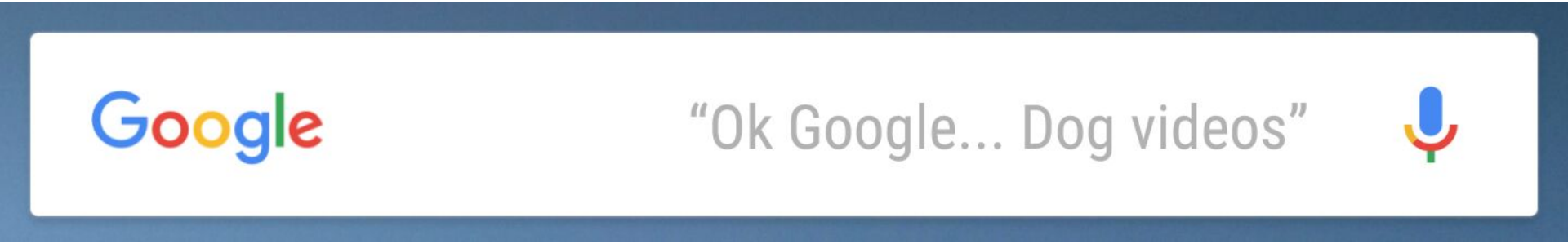


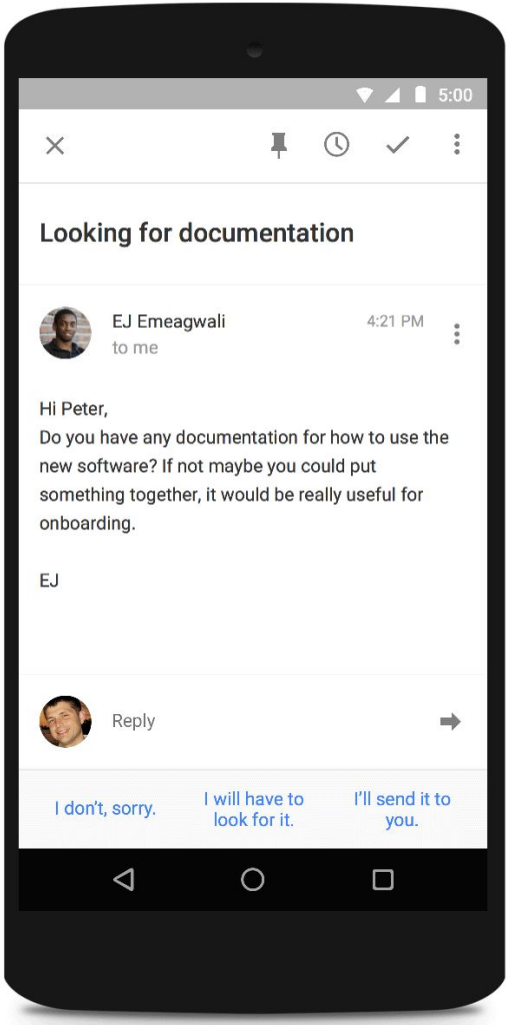

6:00
Listen Now
It's Tuesday afternoon
Play something for...
Focusing (No Lyrics)
Learning Something
Today's Biggest Hits
Recent activity
Recently played or added
MORE
THE MOTH
The Moth Podcast
WELCOME TO NIGHT VALE
Welcome to Night Vale
StarTalk
StarTalk Radio
The Moth Radio Hour: London Calli..
The Moth Podcast

Google Photos



[glacier]


Google
“Ok Google... Dog videos”



Smart reply in Inbox by Gmail

10%

of all responses sent on mobile

Thanks

asadmemon.com/talks

Slides credit to Google (mostly)

What's Next

asadmemon.com/talks
tensorflow.org

Want to learn more?
Udacity class on Deep Learning, goo.gl/iHssII

Guides, codelabs, videos
MNIST for Beginners, goo.gl/tx8R2b
TF Learn Quickstart, goo.gl/uiefRn
TensorFlow for Poets, goo.gl/bVjFIL
ML Recipes, goo.gl/KewA03
TensorFlow and Deep Learning without a PhD, goo.gl/pHeXe7