AI on a Pi

Julien Simon <@julsimon>
AI Evangelist, EMEA

aws


commodore
PET
2001 Series
personal
computer


hello.


10:15 AM
WED, JUN 18
STOCK EXCHANGE
GXX100
1,153.05
1,256.11
1,147.02
1,146.91
MARKET SUMMARY
191,257,05
257,288,120
12,524
Message
Phone
Calendar
Settings
Music
News
Camera
Search
Options
Help
Cancel
mobile

All along,
what we really dreamed about was…

Natural language

Conversational

Smart

Connected

AWS customers
are building this,
right now


amazon
echo
amazon
25,000
skills

Liberty Mutual.
INSURANCE

https://www.libertymutual.com/liberty-mutual-mobile/amazon-ale

aws

iRobot

Connected Roomba launched in 2015

More than 45 million square meters mapped

Discovery and interaction with Smart Home devices

https://aws.amazon.com/solutions/case-studies/irobot/

aws

"Car as a Sensor"

Collect sensor data from BMW 7 Series cars to give drivers dynamically updated map information

100,000 vehicles by 2018

Service launched in 6 months

https://aws.amazon.com/solutions/case-studies/bmw/

aws

As soon as 2018, Alexa will be your companion in

« Alexa, drive me home » can’t be far away

https://techcrunch.com/2017/09/27/bmw-to-bring-alexa-to-its-cars-starting-in-2018/
https://www.youtube.com/watch?v=ogH1Zr13Swg

Last June, tuSimple drove an autonomous truck

for 200 miles from Yuma, AZ to San Diego,

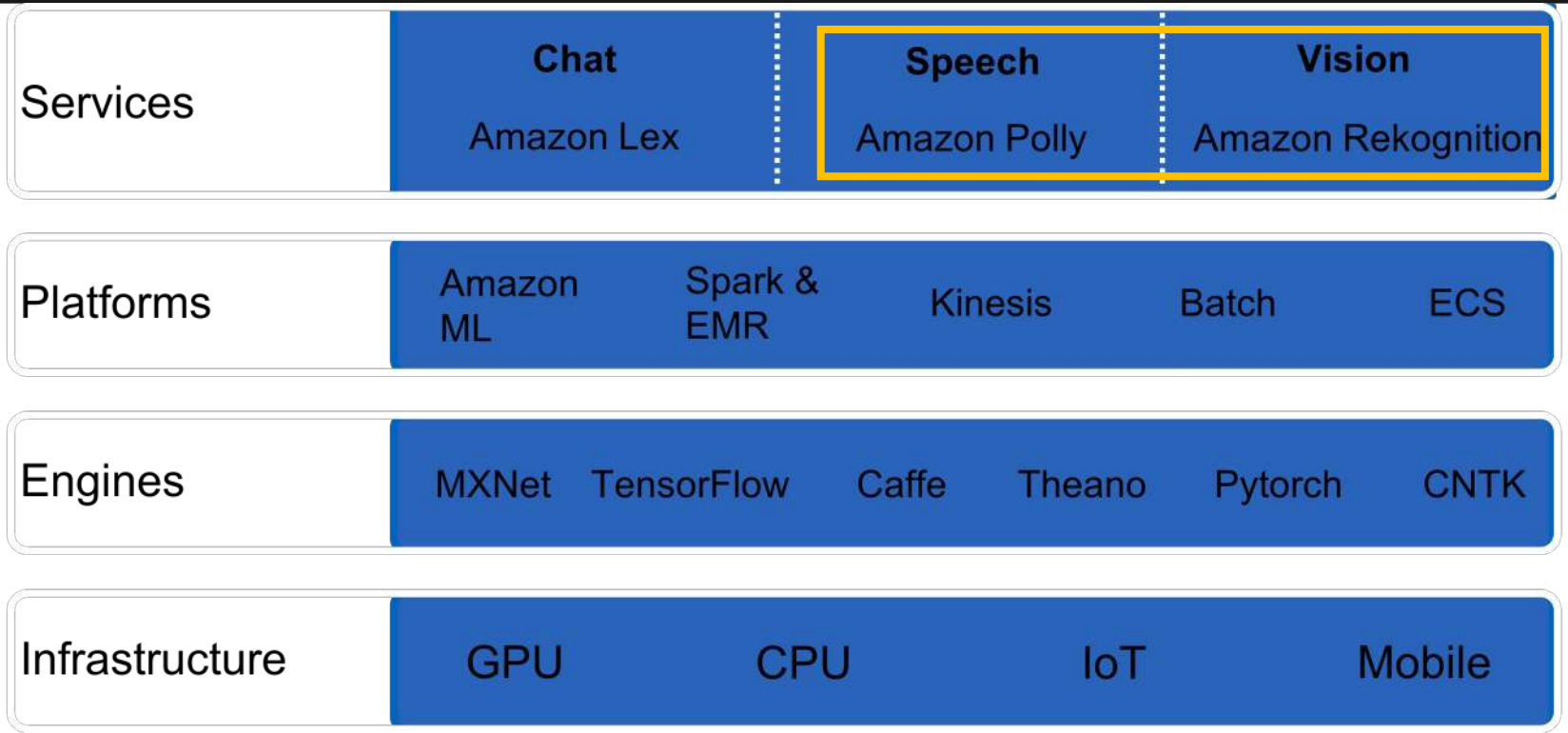
https://www.oreilly.com/ideas/self-driving-trucks-enter-the-fast-lane-using-deep-learning

Amazon AI

Intelligent Services Powered By Deep Learning

aws

Amazon AI for every developer



Polly: Life-like Speech Service

Converts text
to life-like speech

Fully
managed

48
voices

24
languages

Low
latency,
real time

Polly: A Focus On Voice Quality & Pronunciation

1. Automatic, Accurate Text Processing

“Today in Seattle, WA, it’s 11°F”

‘"We live for the music" live from the Madison Square Garden.’

Polly: A Focus On Voice Quality & Pronunciation

1. Automatic, Accurate Text Processing

2. Intelligible and Easy to Understand

aws

Polly: A Focus On Voice Quality & Pronunciation

1. Automatic, Accurate Text Processing
2. Intelligible and Easy to Understand
3. **Add Semantic Meaning to Text**

“Richard’s number is 2122341237“

“Richard’s number is 2122341237“

Telephone Number

Polly: A Focus On Voice Quality & Pronunciation

1. Automatic, Accurate Text Processing
2. Intelligible and Easy to Understand
3. Add Semantic Meaning to Text
4. **Customized Pronunciation**


“My daughter’s name is Kaja.”


“My daughter’s name is Kaja.”

aws

Polly: Life-like Speech Service

High quality, through best-in-class deep learning

Deep functionality

Easy to use & thoughtfully integrated

Built for production

Low cost

Rekognition: Search & Understand Visual Content

Real-time & batch image analysis

Object & Scene Detection

Facial Detection

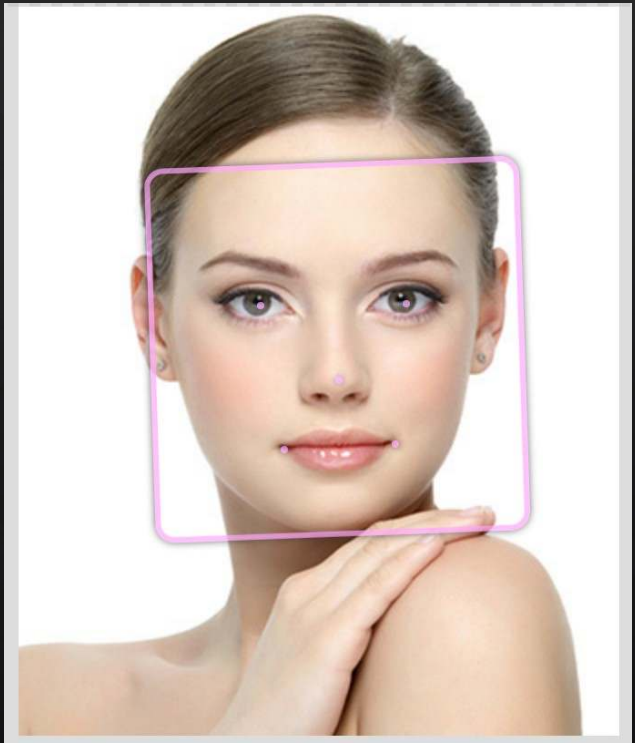
Facial Analysis

Face Search

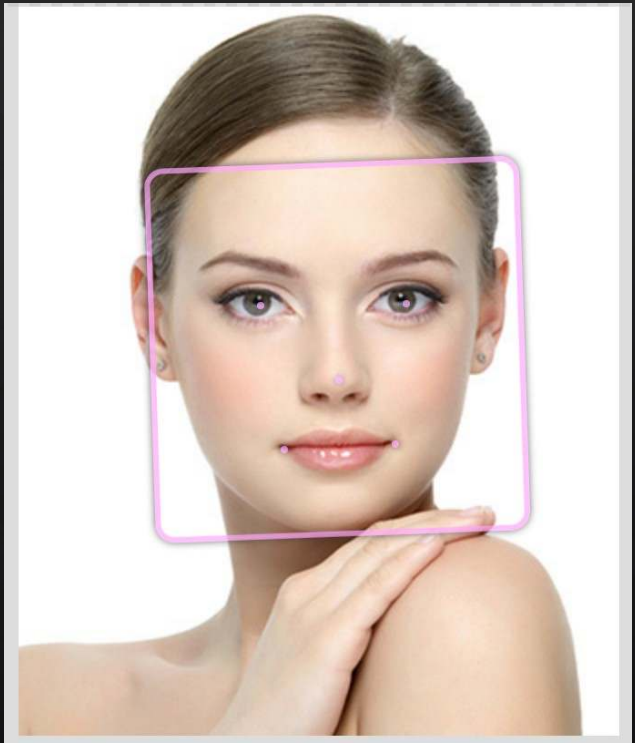
Rekognition: Object & Scene Detection

Beach	99%
Coast	99%
Outdoors	99%
Sea	99%
Water	99%
Palm Tree	98.5%
Plant	98.5%
Tree	98.5%
Landscape	51.5%
Nature	51.5%

Rekognition: Facial Detection

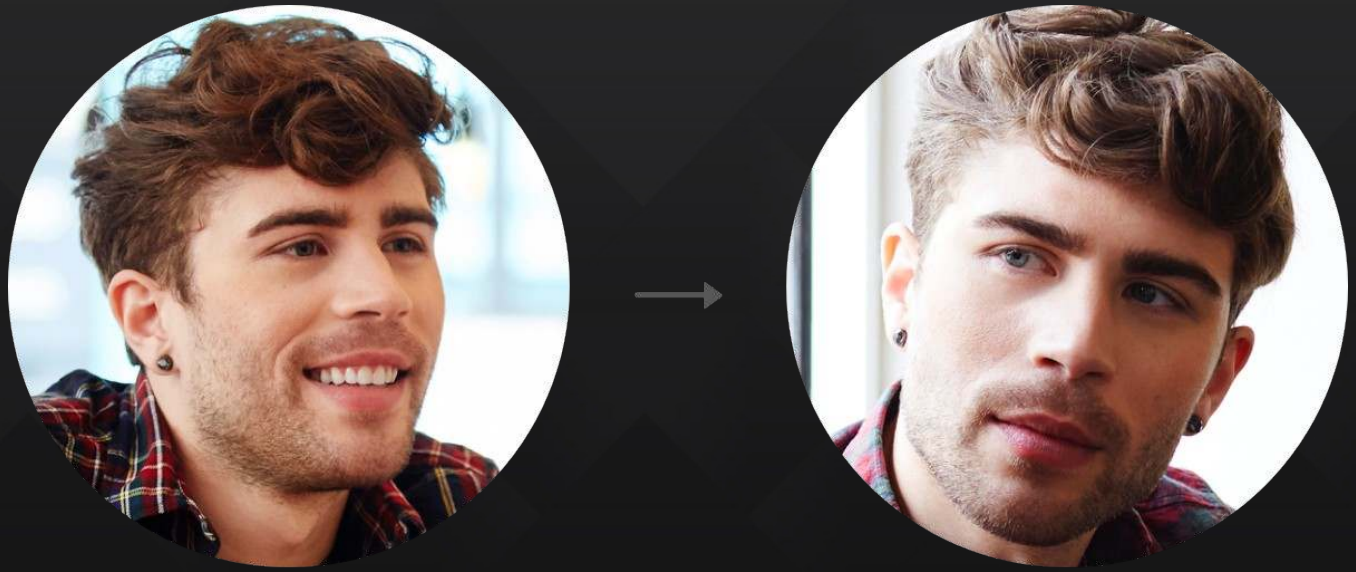


Rekognition: Facial Analysis



looks like a face	99.8%
appears to be female	100%
age range	26 - 43 years old
smiling	84.4%
appears to be happy	55%
appears to be calm	51.6%
not wearing glasses	99.9%
not wearing sunglasses	99.9%
eyes are open	99.9%
mouth is closed	99.7%
does not have a mustache	99.9%
does not have a beard	99.9%

Rekognition: Compare Faces



Rekognition: Facial Search

Facial verification

Compare two faces

Face Search

Compare many faces

Visual Similarity Search

Find similar faces

Celebrity Detection

Sports, music, movies, etc.

Content Moderation

Explicit, suggestive, etc.

Rekognition: Search & Understand Visual Content

High quality, through best-in-class deep learning

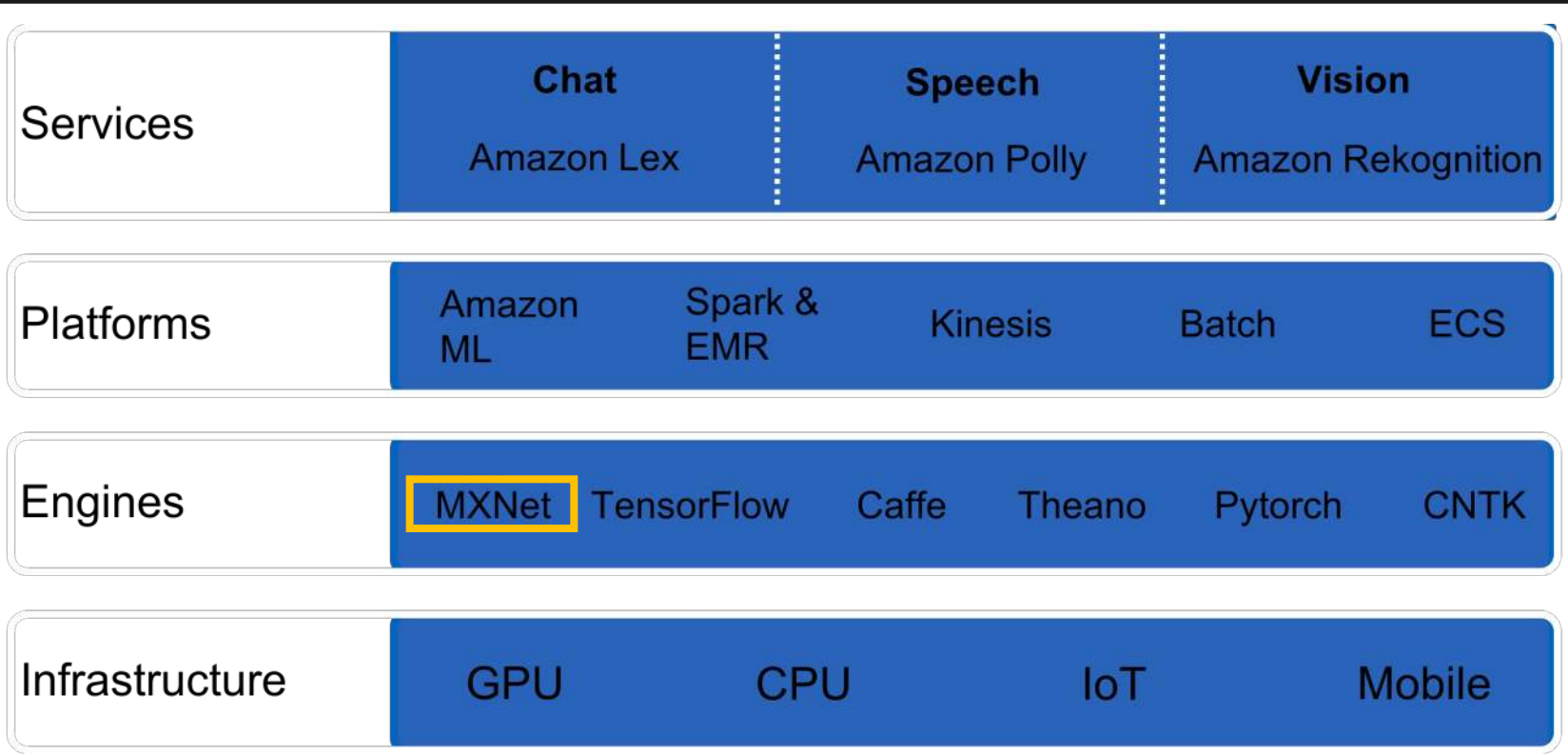
Deep functionality

Easy to use & thoughtfully integrated

Built for production

Low cost

Amazon AI for every developer



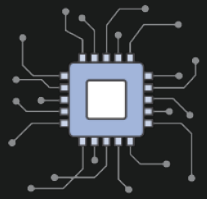
Apache MXNet: Open Source library for Deep Learning

Programmable

Simple syntax,
multiple languages

Portable

Highly efficient
models for mobile
and IoT



High Performance

Near linear scaling
across hundreds of GPUs

Most Open

Accepted into the
Apache Incubator

Best On AWS

Optimized for
Deep Learning on AWS

More information at
mxnet.io

mx.model.FeedForward

model.fit

Input

Output

mx.sym.SoftmaxOutput

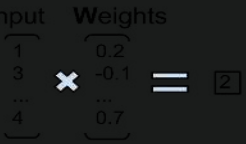
Image

Video

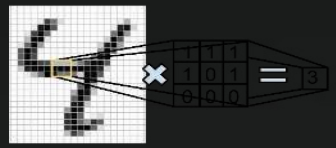
Events

"People Riding Bikes"

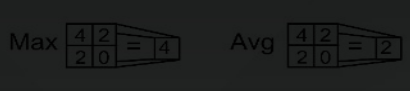
Text



mx.sym.**FullyConnected**(data, num_hidden=128)

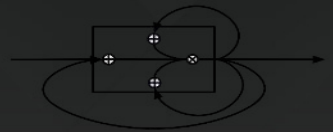


mx.sym.**Convolution**(data, kernel=(5,5), num_filter=20)

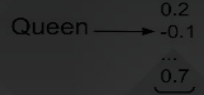


mx.sym.**Pooling**(data, pool_type="max", kernel=(2,2),

stride=(2,2)



lstm.lstm_unroll(num_lstm_layer, seq_len, len, num_hidden, num_embed)



mx.symbol.**Embedding**(data, input_dim, output_dim = k)

mx.sym.**Activation**(data, act_type="xxxx")

"sigmoid"

"tanh"

"relu"

"softrelu"

Image Segmentation

Face Search

Neural Art

"People Riding Bikes"

Image Caption

Bicycle, People, Road, Sport

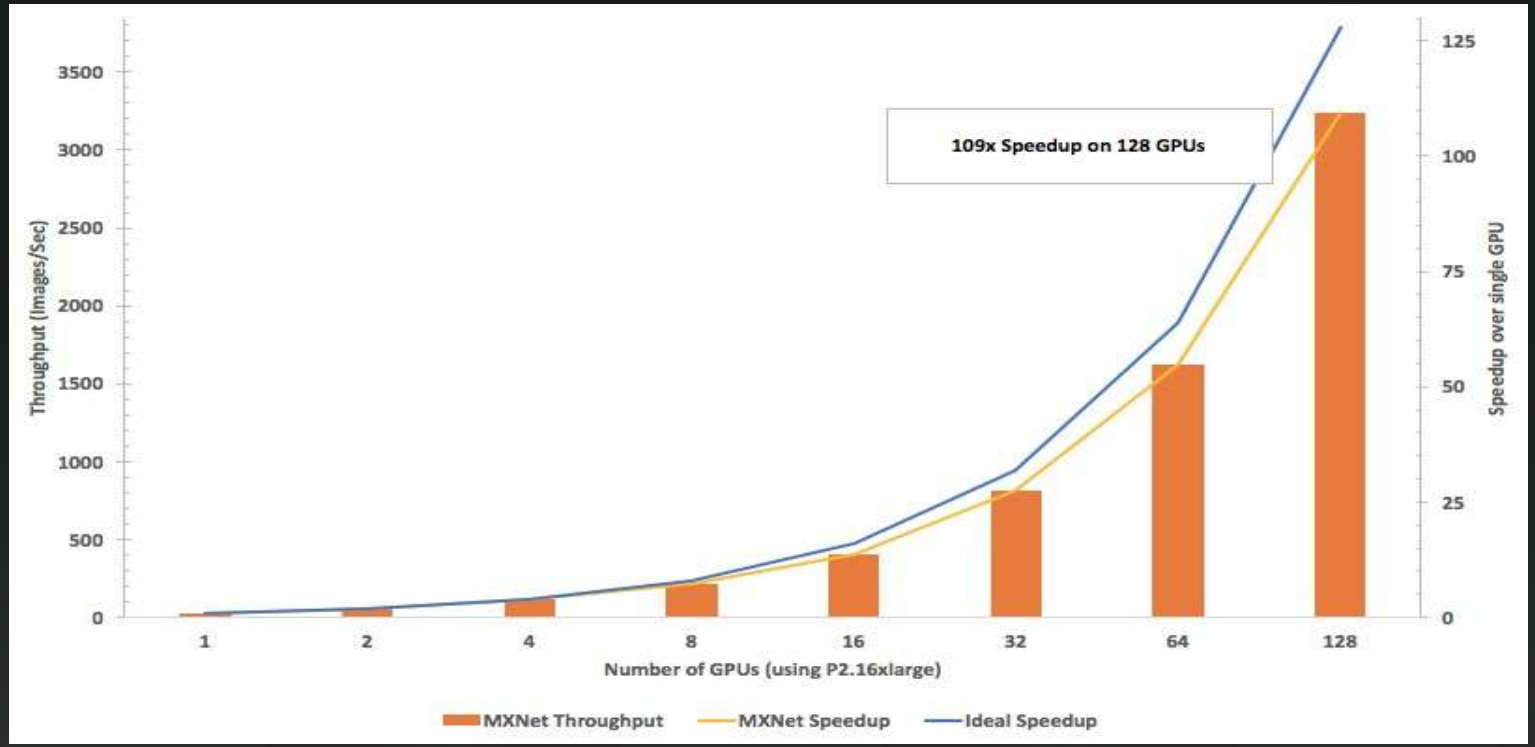
Image Labels

"Οι άνθρωποι ιππασίας ποδήλατα"

Machine Translation

aws

MXNet: near-linear training scalability



AWS Deep Learning AMI

Up to~40k CUDA cores

Apache MXNet

TensorFlow

Theano

Caffe

Torch

Pre-configured CUDA drivers

Anaconda, Python3

+ CloudFormation template

+ Container Image

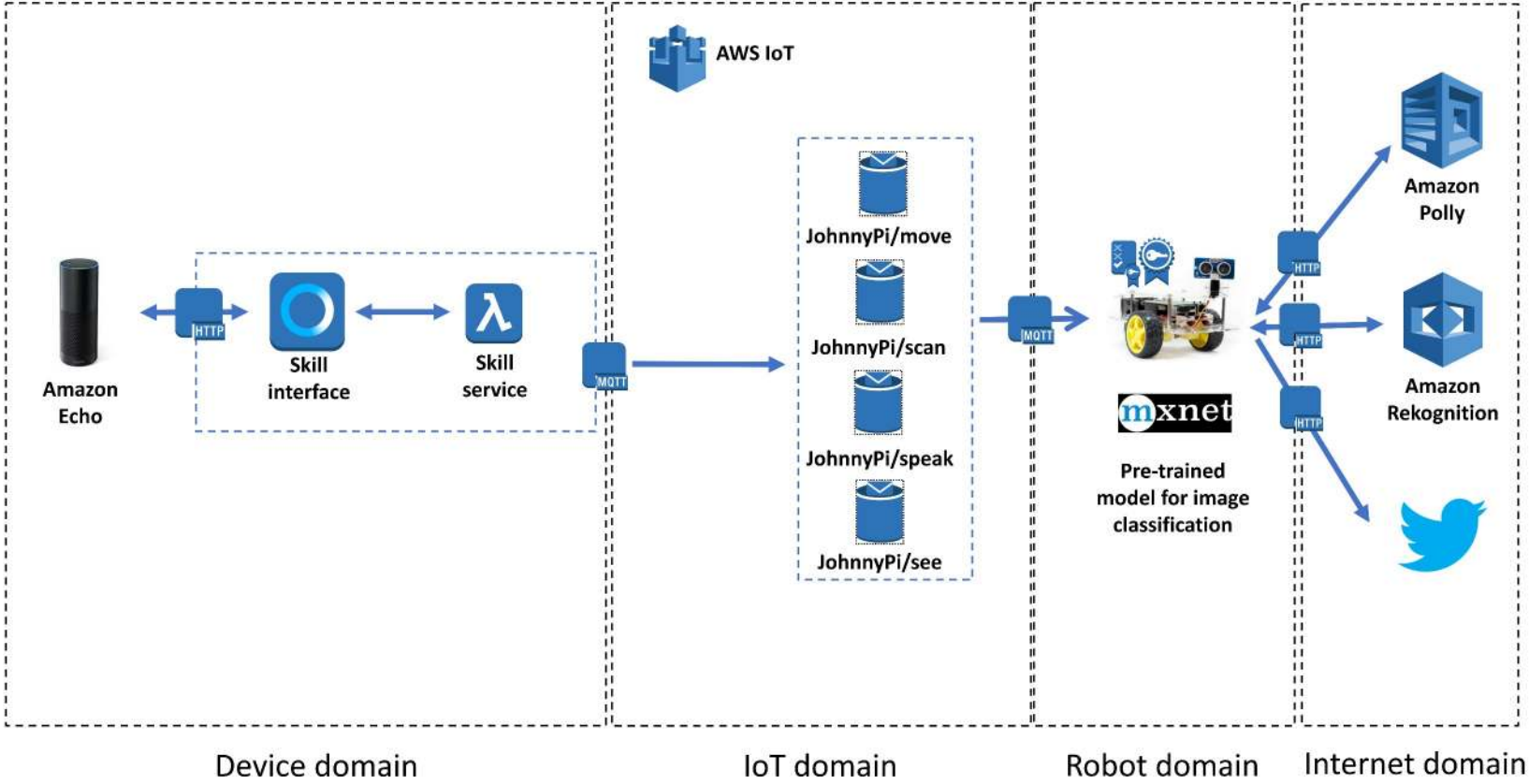
One-Click GPU Deep Learning

aws

So, how about we build a voice-powered robot that can see and speak?

Voice-driven AI robot: 250€, 700 lines of code

https://medium.com/@julsimon/johnny-pi-i-am-your-father-part-0-1eb537e5a36
https://github.com/juliensimon/johnnypi



Who does what?

- Skiill interaction model
  - Utterances (32)
  - Custom slots
    - Movement (7)
    - Target (2)
- Skill Lambda function
  - Python (225 LOC)
  - Handles session
  - Sends IoT messages with robot commands
- AWS IoT gateway
  - Zero code, configuration only

- Raspberry Pi app
  - Python server (400 LOC)
  - Receives IoT messages
  - Calls robot API for movement
  - Calls Polly API for speech
  - Calls Reko API for faces
  - Calls Twitter API
  - Uses local MXNet model for objects
  - Complex CNN: Inception v3
    - Pre-trained on Imagenet
    - Animals and objects, no humans
    - 1000 categories

Sample utterances

```
DirectionIntent move {Direction}
DirectionIntent go {Direction}
DirectionIntent turn {Direction}
DirectionIntent now move {Direction}
DirectionIntent now go {Direction}
DirectionIntent now turn {Direction}
DirectionIntent go {Direction} please
DirectionIntent move {Direction} please
DirectionIntent turn {Direction} please
DirectionIntent I want you to go {Direction}
DirectionIntent I want you to move {Direction}
DirectionIntent I want you to turn {Direction}
DirectionIntent {Direction}
```

```
SeeIntent Look at the {Target}
SeeIntent Take a look at the {Target}
SeeIntent Just look at the {Target}
SeeIntent Tell me about the {Target} you see
SeeIntent Tell me about the {Target} in front of you
SeeIntent What is the {Target} in front of you
SeeIntent Do you see the {Target} in front of you
SeeIntent Do you see an {Target}
SeeIntent Do you see {Target}
SeeIntent Describe the {Target} you see
```

Please suggest additional ones

☺

Anything you dream is fiction, and anything you accomplish is science, the whole history of mankind is nothing but science fiction.

Ray Bradbury

Get started at

http://aws.amazon.com/ai

http://aws.amazon.com/iot

http://aws.amazon.com/evangelists/julien-simon

@julsimon

aws