

AI on a Raspberry Pi

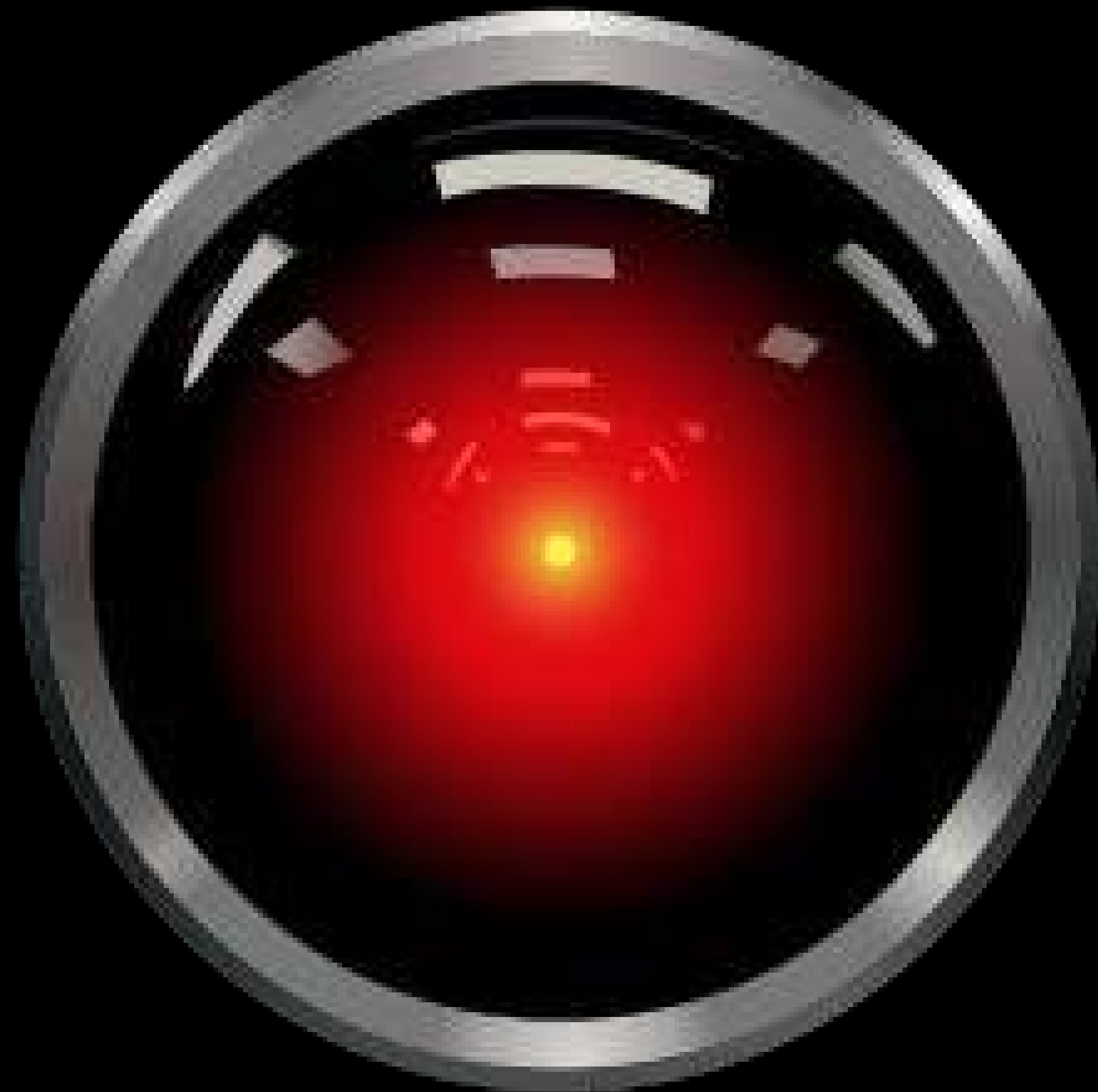
Julien Simon, Principal Technical Evangelist, AWS

@julsimon



Agenda

- AI: The Story So Far
- Amazon AI
- Apache MXNet overview
- Apache MXNet demos
- Tools and Resources

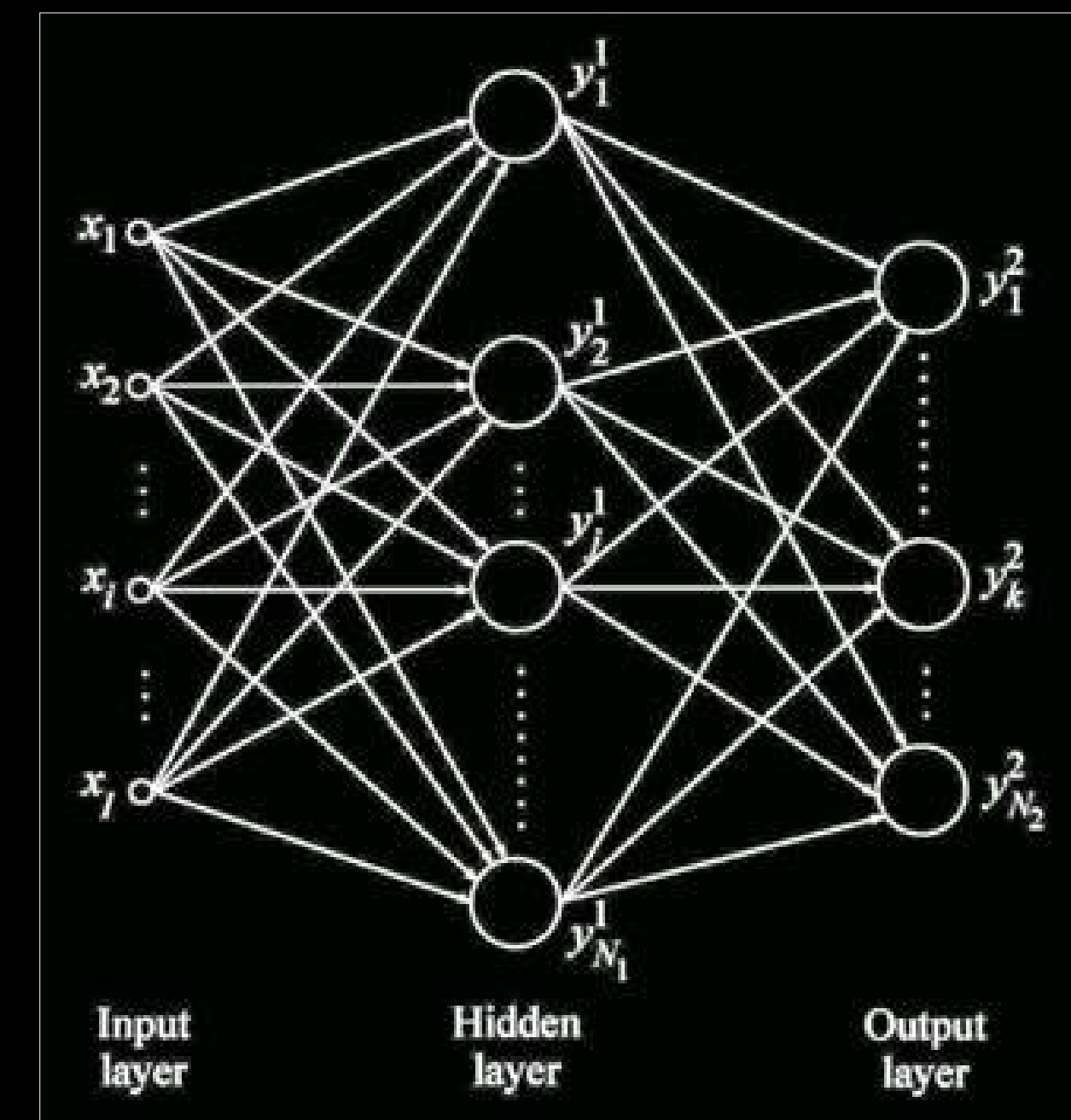
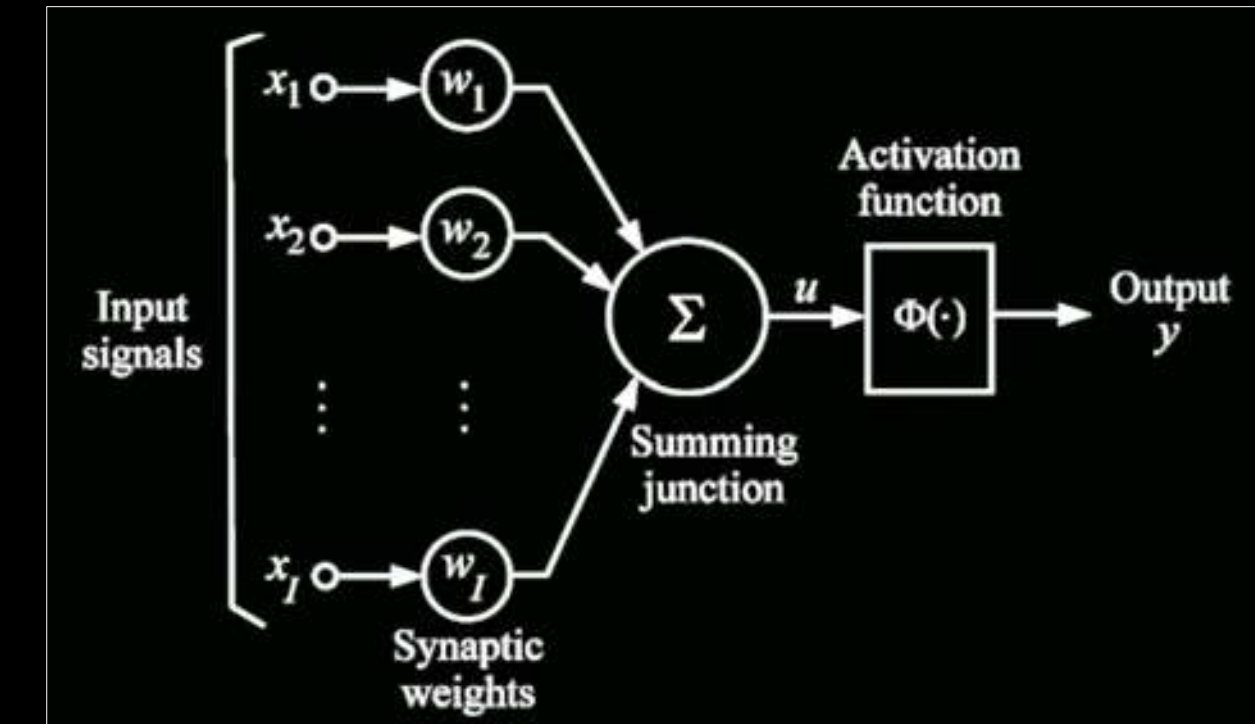


Where is HAL?

- Machine Learning is now a **commodity**, but still no HAL in sight
- Traditional Machine Learning **doesn't** work well with problems where features can't be **explicitly** defined
- So what about solving tasks that are **easy for people** to perform, but **hard to describe** formally?
- Is there a way to get **informal knowledge** into a computer?

Neural Networks, Revisited

- Universal approximation machine
- Through training, a neural network discovers features automatically
- Not new technology!
 - Perceptron - Rosenblatt, 1958
image recognition, 20x20 pixels
 - Backpropagation - Werbos, 1975
- They failed back then because:
 - Data sets were too small
 - Solving large problems with fully connected networks required too much memory and computing power, aka the Curse of Dimensionality



Why It's Different This Time

Everything is digital: **large data sets** are available

- Imagenet: 14M+ labeled images - <http://www.image-net.org/>
- YouTube-8M: 7M+ labeled videos - <https://research.google.com/youtube8m/>
- AWS public data sets - <https://aws.amazon.com/public-datasets/>

The parallel computing power of **GPUs** make training possible

- Simard (2005), Ciresan (2011)
- State of the art networks have **hundreds** of layers
- Baidu's Chinese speech recognition: 4TB of training data, **+/- 10 Exaflops**

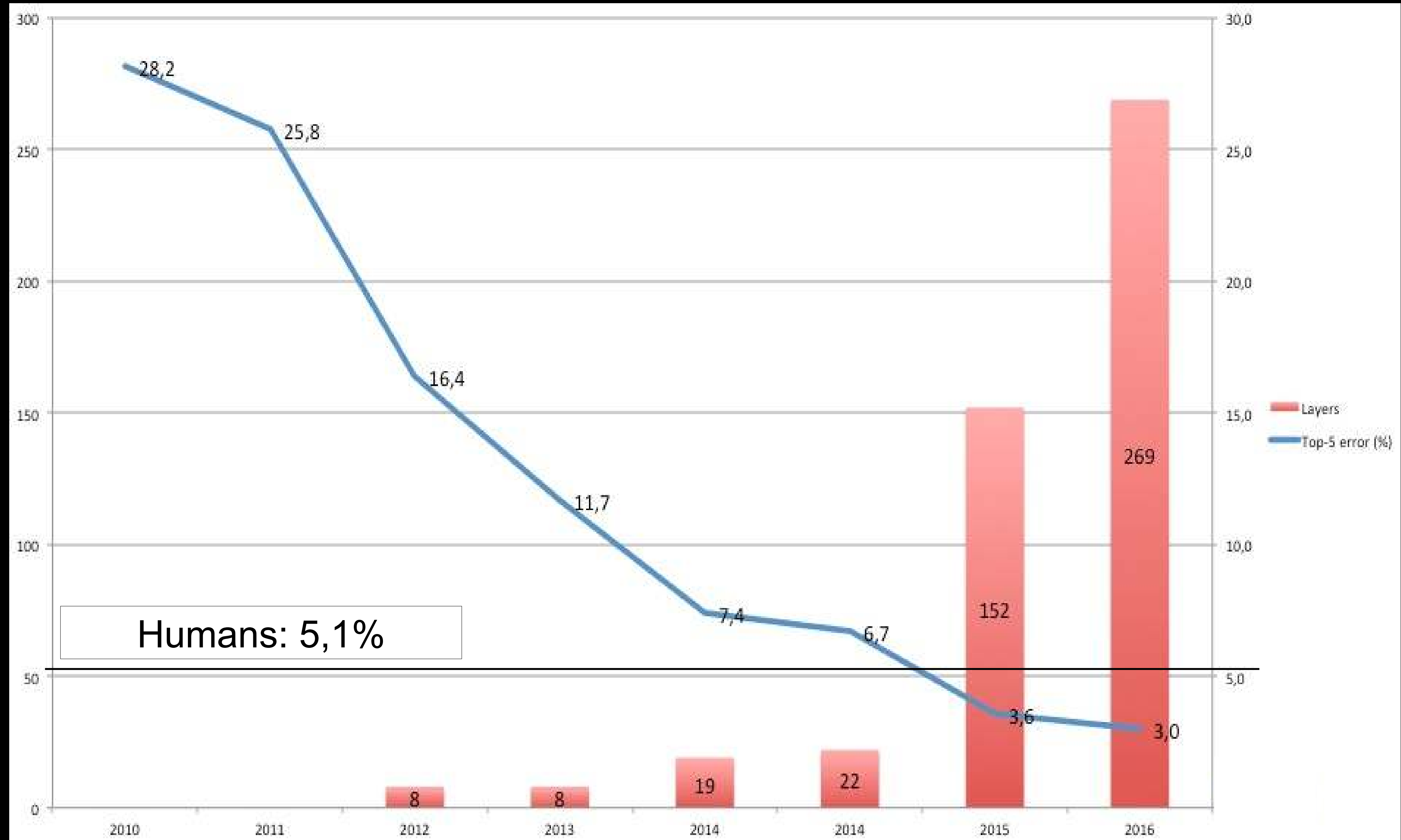
Cloud scalability and **elasticity** make training affordable

- **Grab** a lot of resources for fast training, then **release** them
- Using a DL model is lightweight: you can do it on a **Raspberry Pi**

ImageNet Large Scale Visual Recognition Challenge (ILSVRC)



Same breed?



Amazon AI

Thousands of Amazon Engineers Focused on AI



Fulfilment &
Logistics



Search &
Discovery



Existing
Products

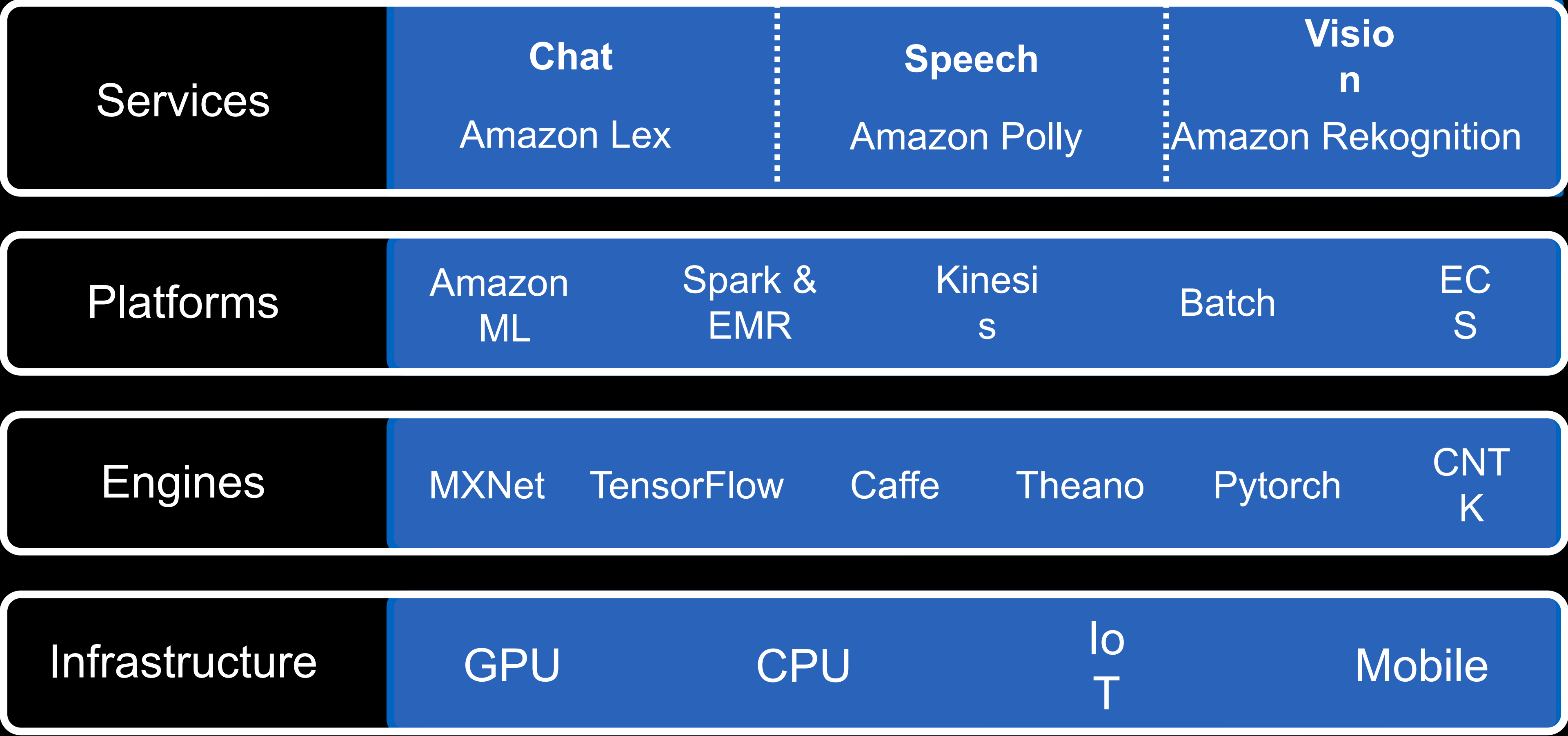


New
Products



Amazon Echo

Amazon AI: Artificial Intelligence In The Hands Of Every Developer



Amazon Polly: Text To Speech Powered By Deep Learning

“The temperature
in WA is 75°F”



“The temperature
in Washington is 75 degrees
Fahrenheit”

Amazon Polly

Text In, Life-like Speech Out

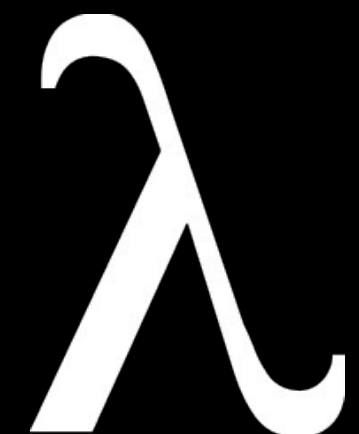
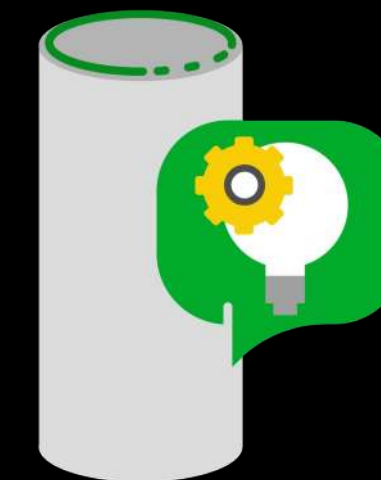
Amazon Lex

Speech Recognition & Natural Language Understanding

Amazon Lex

Automatic Speech Recognition
Natural Language Understanding

“What’s the weather
forecast?”



“It will be sunny
and 75 degrees
Fahrenheit”



Amazon Polly



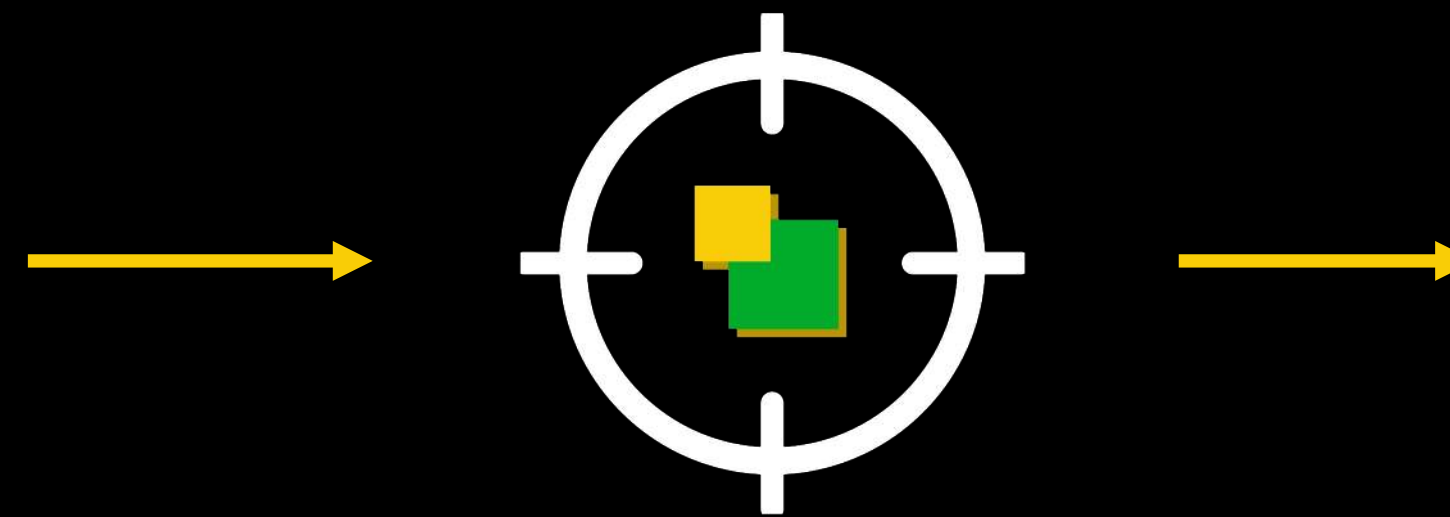
“It will be
sunny
and 75F”



Weather
Forecast

Amazon Rekognition

Image Recognition And Analysis Powered By Deep Learning



Amazon Rekognition

Objects/Scenes

Car
Outside
Daytime
Driving

Faces

Female
Smiling
Sunglasses

Images In, Categories and Facial Analysis Out

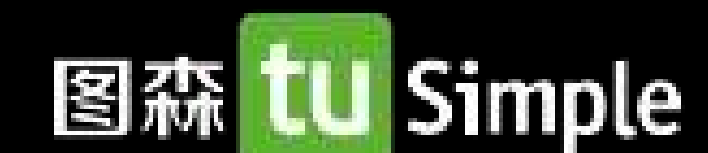
Demo #1 – Amazon Polly & Rekognition

<https://medium.com/@julsimon/a-hands-on-look-at-the-amazon-rekognition-api-e30e19e7d88b>

<https://medium.com/@julsimon/amazon-polly-hello-world-literally-812de2c620f4>

<https://github.com/juliensimon/aws/tree/master/rekognition>

Artificial Intelligence on AWS today



Apache MXNet Overview

Apache MXNet



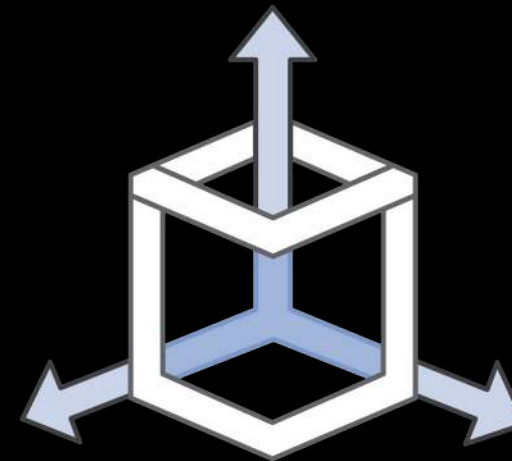
Programmable

Simple syntax,
multiple languages



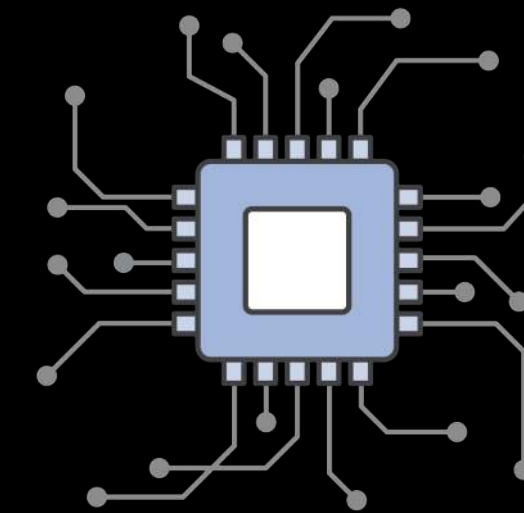
Most Open

Accepted into the
Apache Incubator



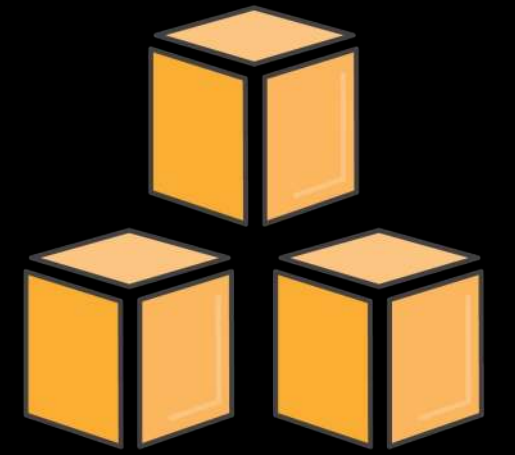
Portable

Highly efficient
models for mobile
and IoT



High Performance

Near linear scaling
across hundreds of GPUs

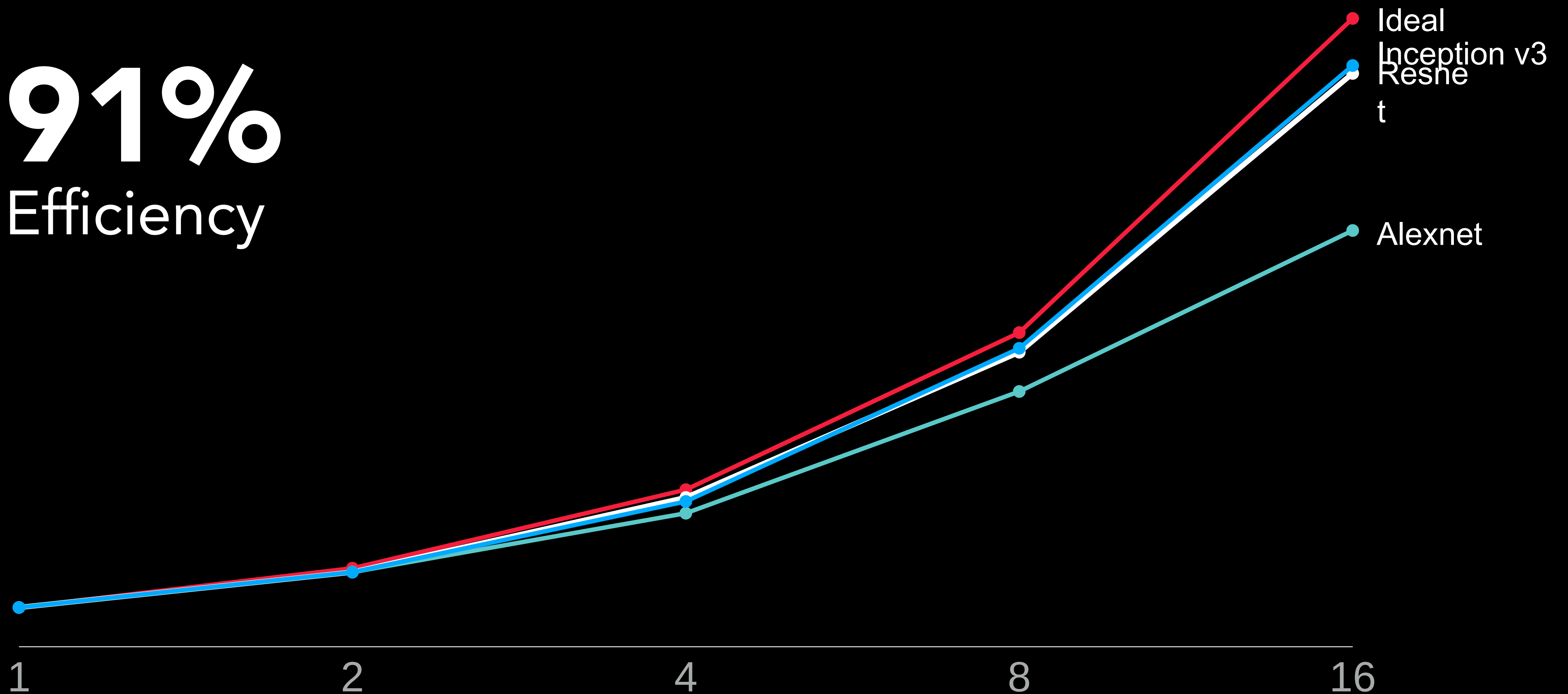


Best On AWS

Optimized for
deep learning on
AWS

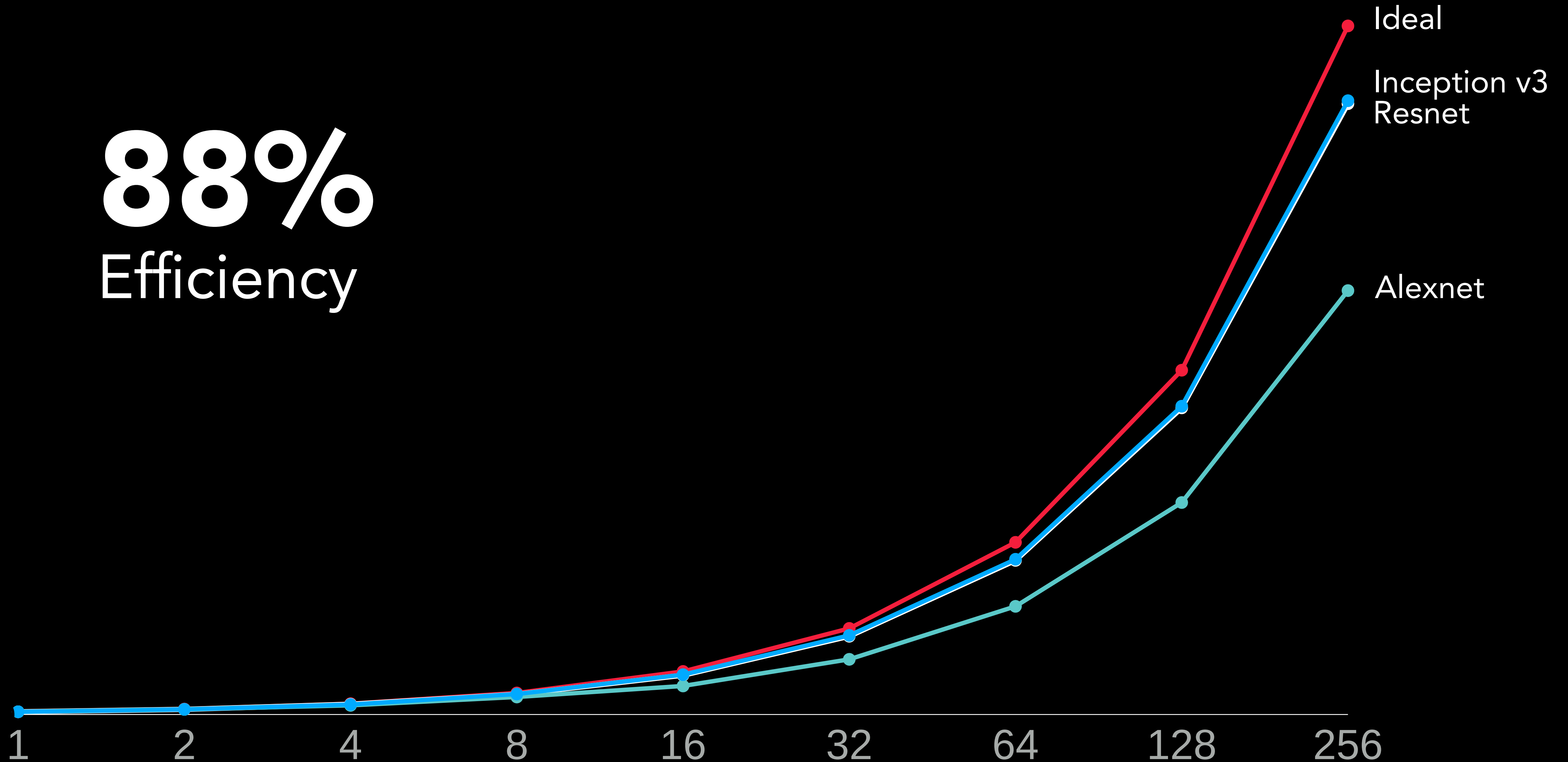
Multi-GPU Scaling With MXNet

91%
Efficiency



Multi-Machine Scaling With MXNet

88%
Efficiency

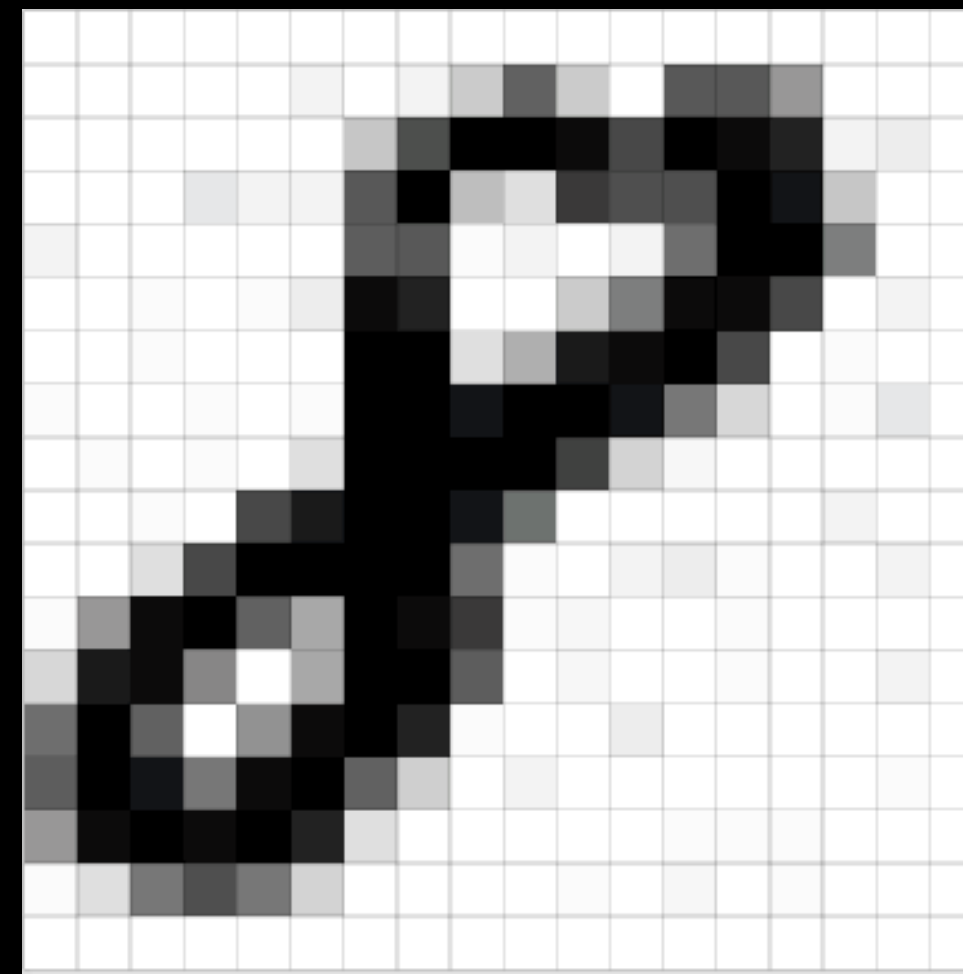


Apache MXNet demos

Demo #2 – Training MXNet on MNIST

<https://medium.com/@julsimon/training-mxnet-part-1-mnist-6f0dc4210c62>

<https://github.com/juliensimon/aws/tree/master/mxnet/mnist>

[illegible]

Demo #3 – Object Detection on a Raspberry Pi

<https://medium.com/@julsimon/an-introduction-to-the-mxnet-api-part-6-fcdd7521ae87>



GoPiGo

@CallMeJohnnyPi



Arduino Yún



AWS
IoT
MQTT



Amazon AI

Intelligent Services Powered By Deep Learning

AWS Deep Learning AMI

Up to~40k CUDA cores

Apache MXNet

TensorFlow

Theano

Caffe

Torch

Keras

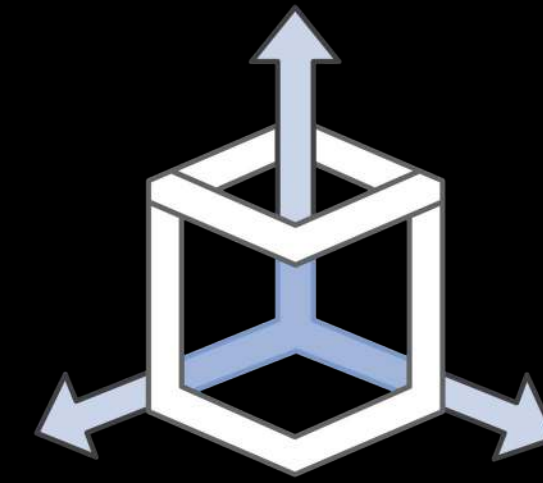
Pre-configured CUDA drivers, MKL

Anaconda, Python3

Ubuntu and Amazon Linux

+ CloudFormation template

+ Container Image



One-Click GPU or CPU Deep Learning

Additional Resources

MXNet Resources

- [MXNet Blog Post | AWS Endorsement](#)
- [Read up on MXNet and Learn More: mxnet.io](#)
- [MXNet Github Repo](#)
- [MXNet Recommender Systems Talk](#) | Leo Dirac

AWS Resources

- [Deep Learning AMI](#) | Amazon Linux
- [Deep Learning AMI](#) | Ubuntu
- [CloudFormation Template Instructions](#)
- [Deep Learning Benchmark](#)
- [MXNet on Lambda](#)
- [MXNet on ECS/Docker](#)



[https://soundcloud.com/amazon-web-services-306355661/
200-introduction-to-apache-mxnet-on-aws](https://soundcloud.com/amazon-web-services-306355661/200-introduction-to-apache-mxnet-on-aws)



Grazie mille!

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