Scalable Deep Learning on AWS using Apache MXNet

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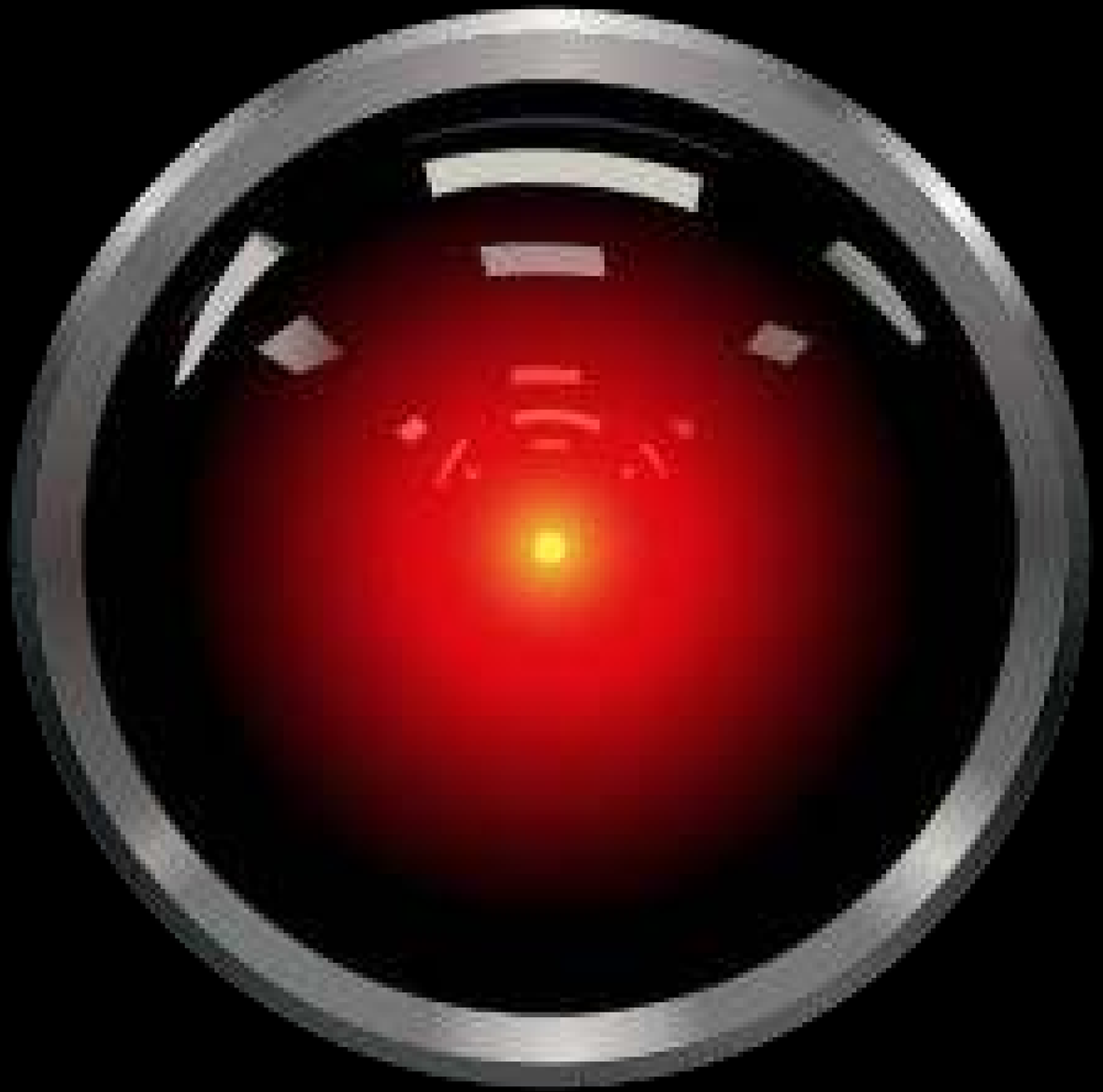
@julsimon

Agenda

- AI: The Story So Far
- Applications of Deep Learning
- Apache MXNet Overview
- Apache MXNet API
- Code and Demos
- Tools and Resources

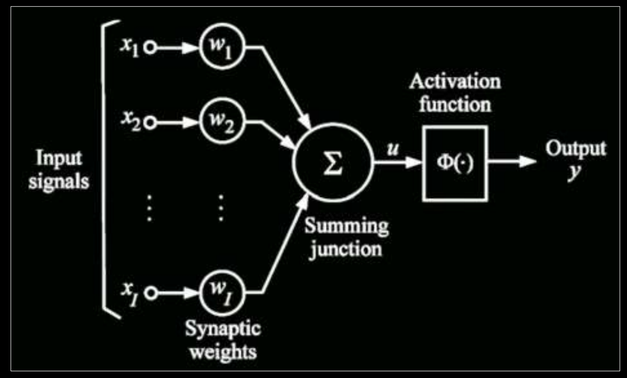


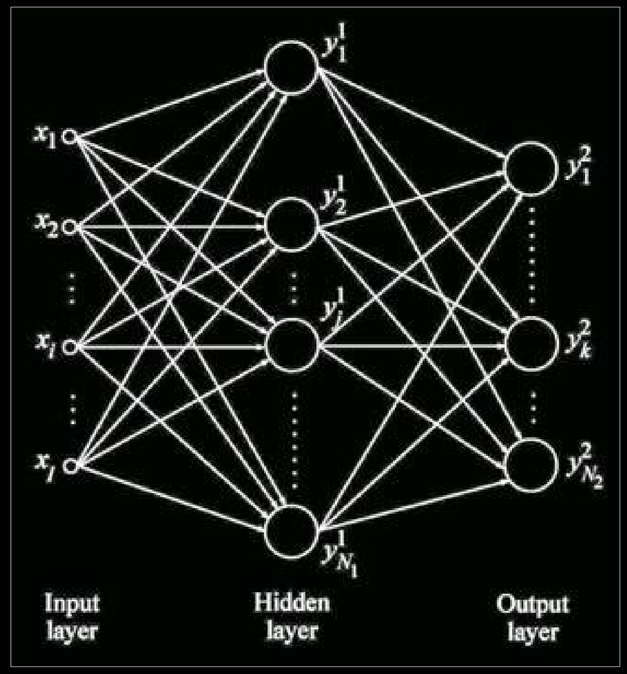
Where is HAL?

- 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

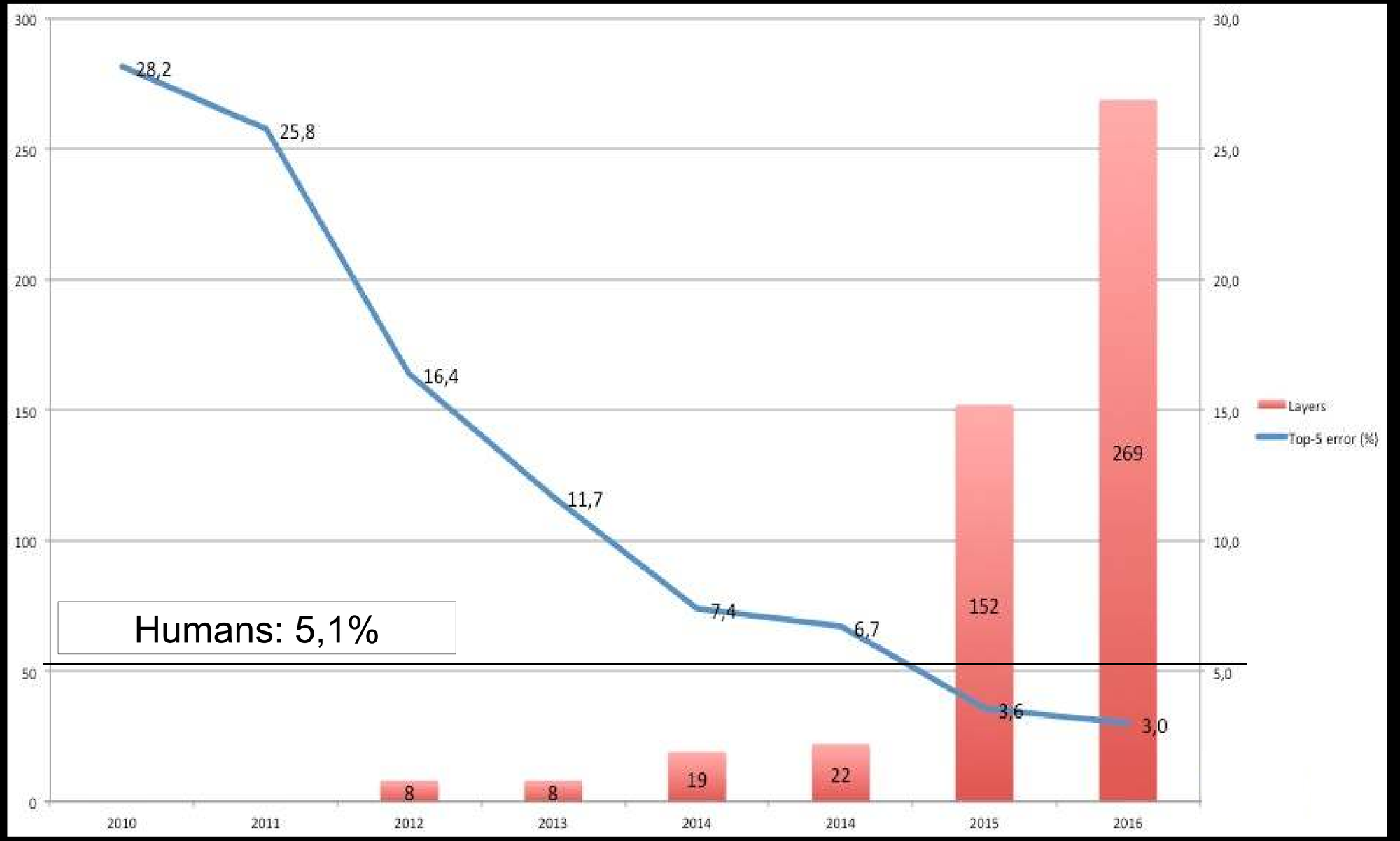
Cloud scalability and elasticity make training affordable

- 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

Applications of Deep Learning

ImageNet Large Scale Visual Recognition Challenge (ILSVRC)

Same breed?

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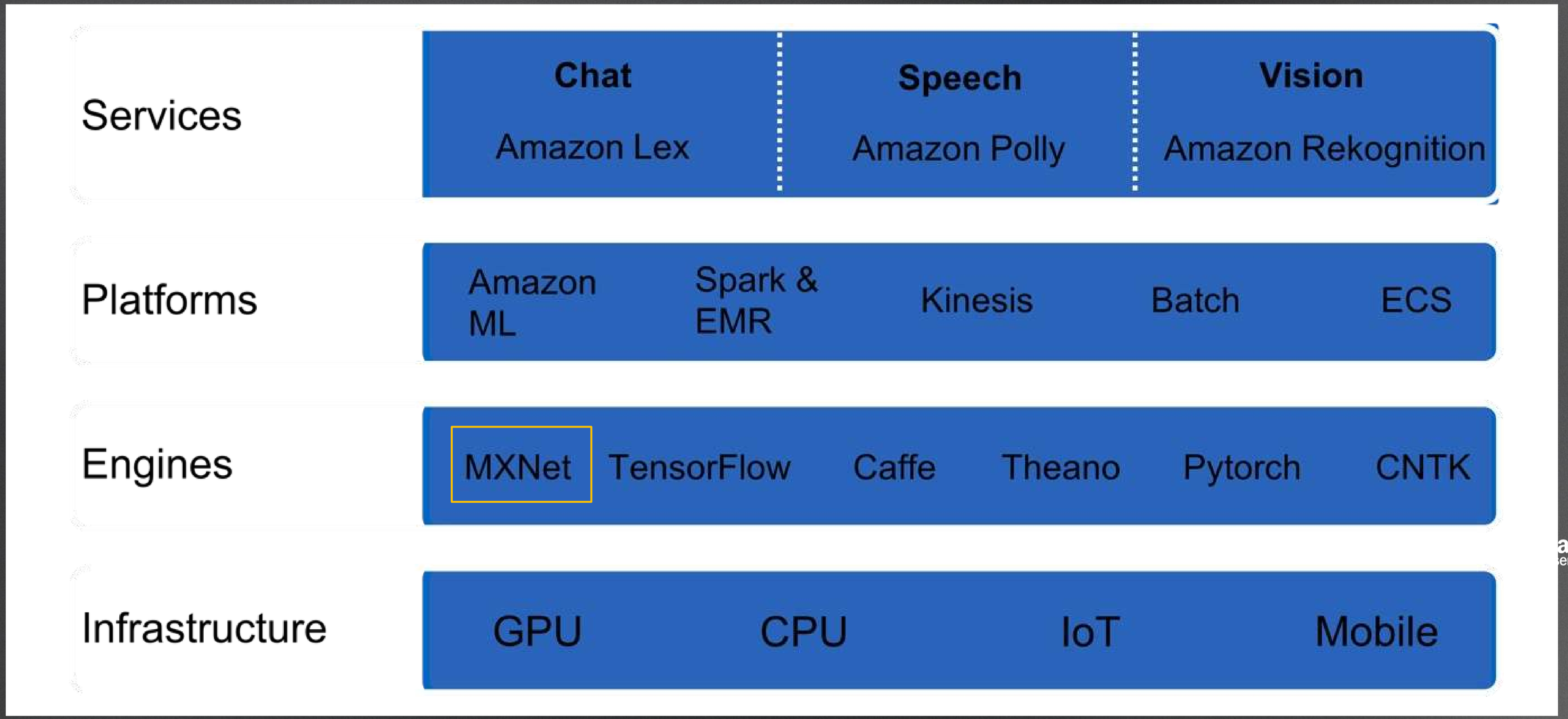
Amazon Echo

https://medium.com/@julsimon/create-your-own-basquiat-with-deep-learning-for-much-less-than-110-million-314aa07c9ba8

Apache MXNet Overview

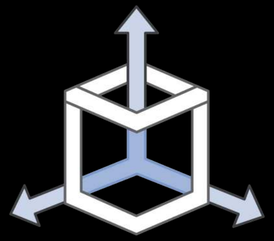
Amazon AI for every developer



Apache MXNet

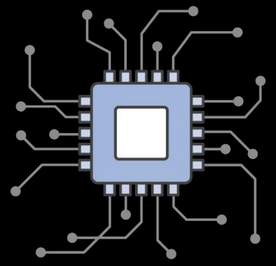
Programmable

Simple syntax,
multiple languages



Portable

Highly efficient
models for mobile
and IoT

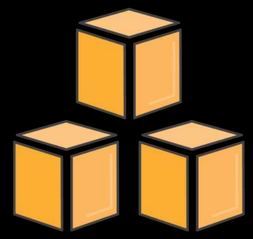


High Performance

Near linear scaling
across hundreds of GPUs

Most Open

Accepted into the
Apache Incubator

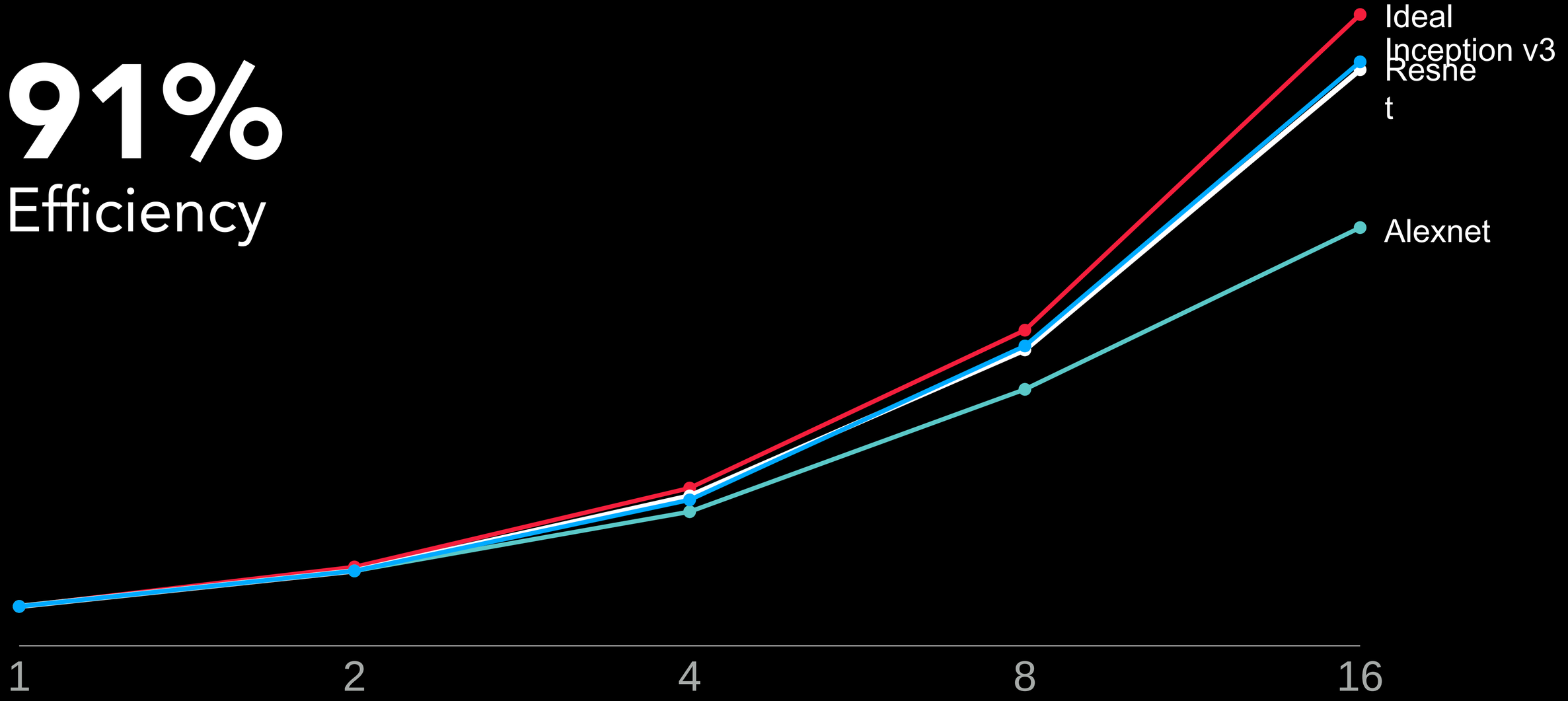


Best On AWS

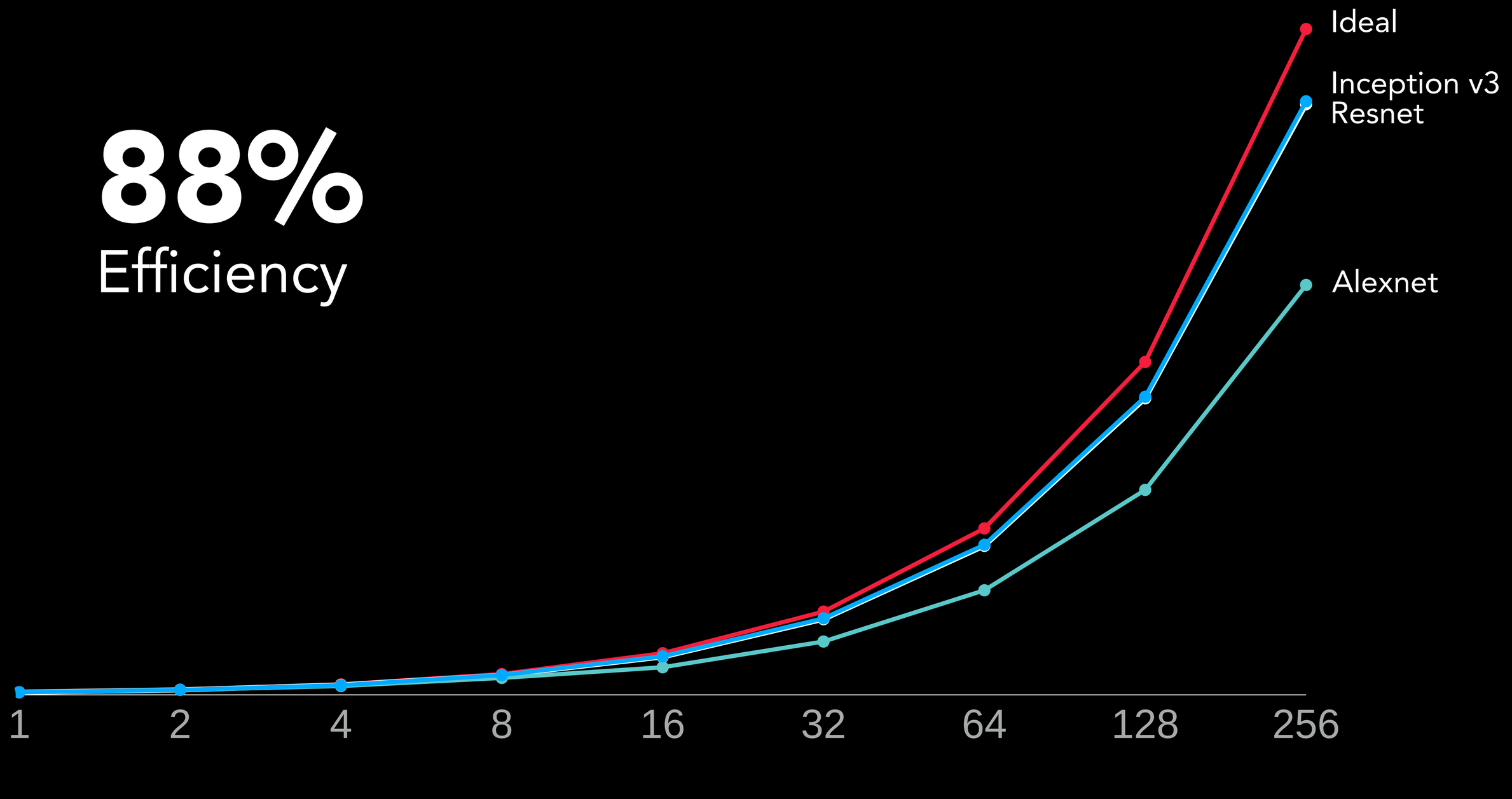
Optimized for
deep learning on
AWS

Multi-GPU Scaling With MXNet

91%
Efficiency



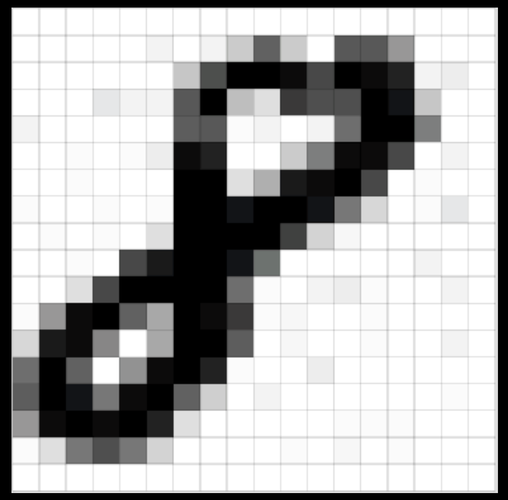
Multi-Machine Scaling With MXNet

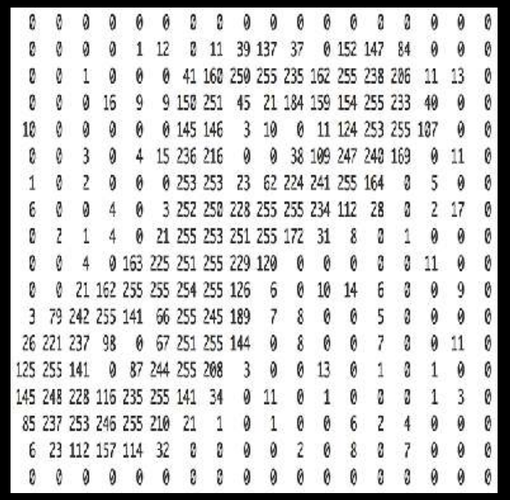


Apache MXNet API

Demo #1 – Training MXNet on MNIST

https://medium.com/@julsimon/training-mxnet-part-1-mnist-6f0dc4210c62
https://github.com/juliensimon/aws/tree/master/mxnet/mnist



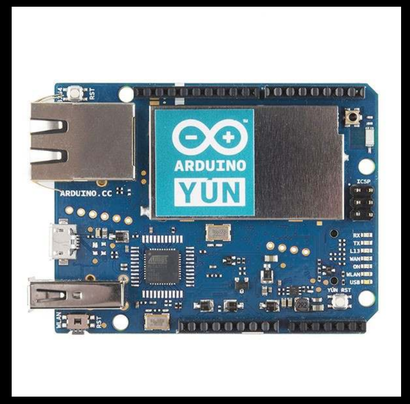


Demo #2 – Object Detection on a Raspberry Pi

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

GoPiGo

@CallMeJohnnyPi



Arduino Yùn

AWS
IoT
MQTT

mxnet

Amazon AI

Intelligent Services Powered By Deep Learning

AWS Deep Learning AMI

Up to~40k CUDA cores

Apache MXNet

TensorFlow

Theano

Caffe

Torch

Keras

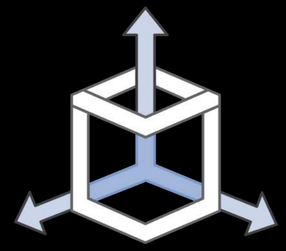
Pre-configured CUDA drivers, MKL

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

Thank You!

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