An introduction to Deep Learning

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AI: the story so far

1956

Dartmouth Summer Research Project

John McCarthy (1927-2011)
1956 - Coined the term "Artificial Intelligence"
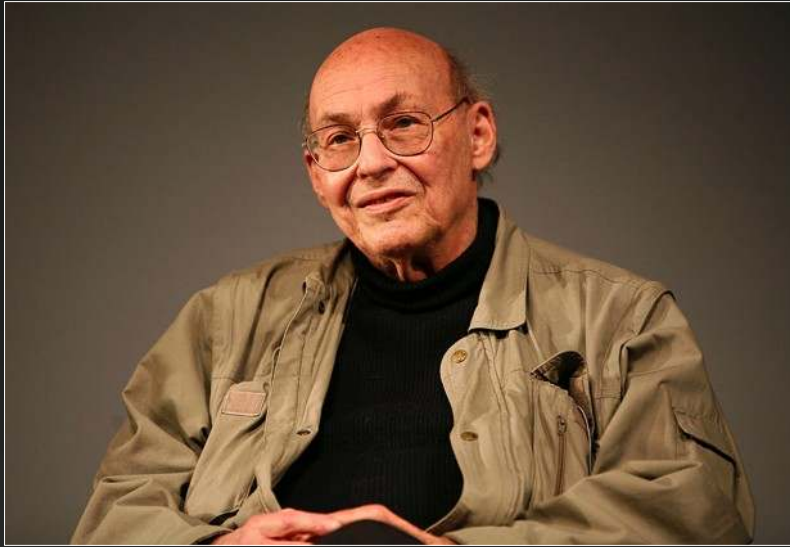1958 - Invented LISP
1971 - Received the Turing Award

Forbidden Planet

Robbie the Robot

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It's 2001. Where is HAL?

« No program today can distinguish a dog from a cat, or recognize objects in typical rooms, or answer questions that 4-year-olds can! »

Marvin Minsky (1927-2016)
1959 - Co-founded the MIT AI Lab
1968 - Advised Kubrick on "2001: A Space Odyssey"
1969 - Received the Turing Award

HAL 9000 (1992-2001)

Millions of users… Mountains of data… Commodity hardware…
Bright engineers… Need to make money….

Gasoline waiting for a match!

12/2004 - Google publishes Map Reduce paper

04/2006 - Hadoop 0.1

The rest is history

Fast forward a few years

- ML is now a commodity, but still no HAL in sight

- Traditional Machine Learning doesn't work well when features can't be explicitly defined

- So what about solving tasks that are easy for people but hard to describe formally?

- Is there a way to get informal knowledge into a computer?

- Why would AI and neural networks work this time?

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AI: why it is 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/

- Deep neural networks can now be trained thanks to GPUs.
  - State of the art networks have hundreds of layers
  - Baidu's Chinese speech recognition: 4TB of training data, +/- 10 Exaflops

- Cloud elasticity makes 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

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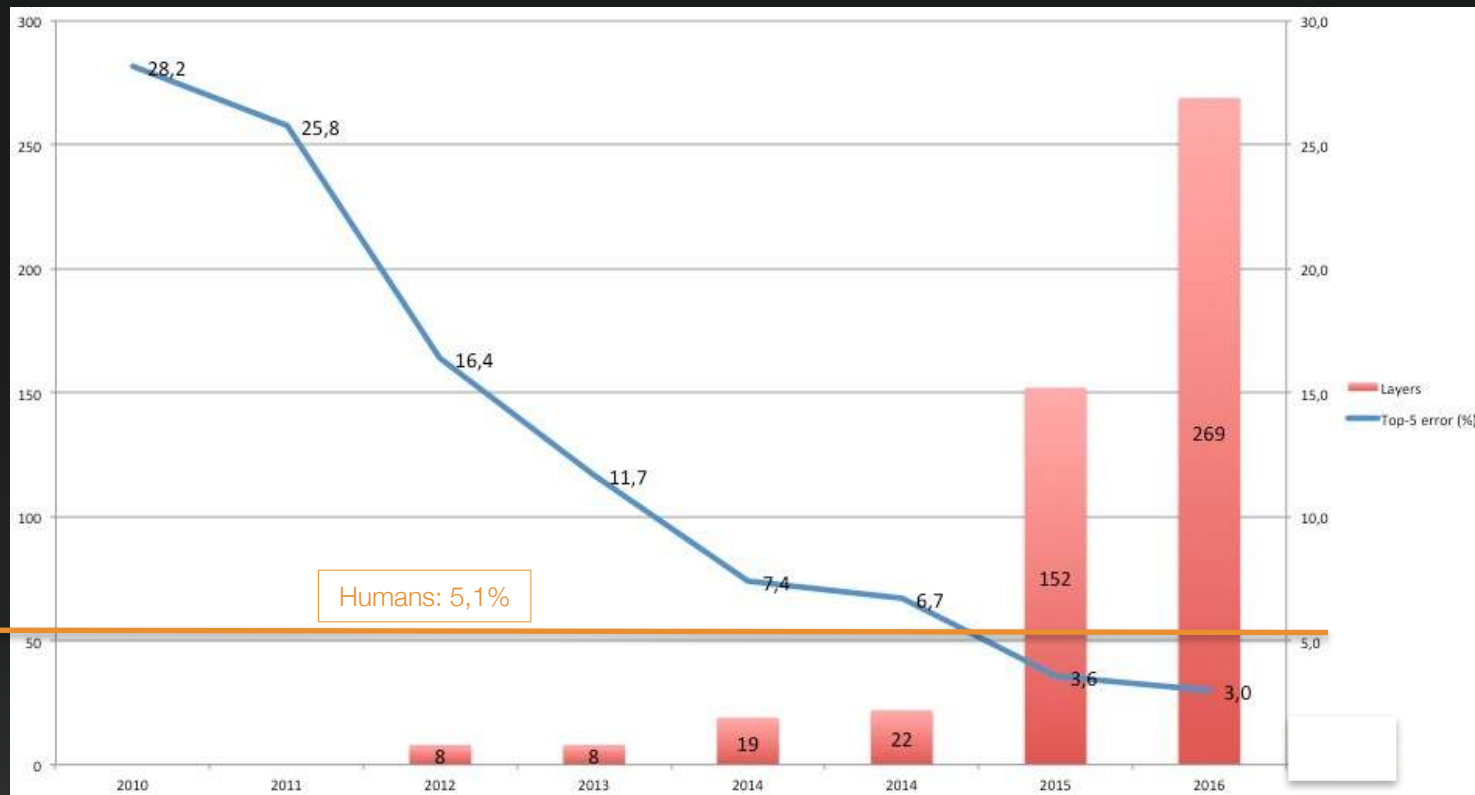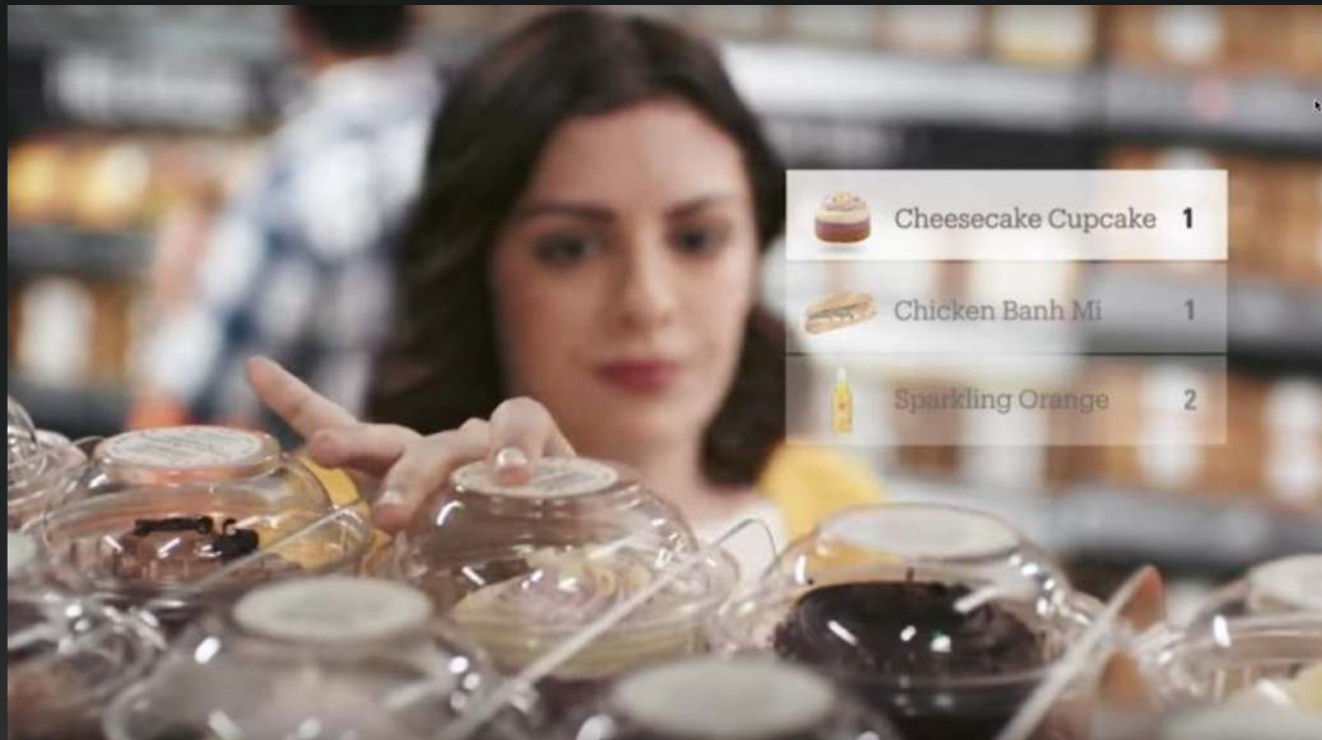Applications of Deep Learning

Image classification

Same breed?

Personal assistants

Line-free shopping

amazon go

	Cheesecake Cupcake	1
	Chicken Banh Mi	1
	Sparkling Orange	2

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Autonomous driving

This past June, a driverless truck passed a 200-mile test drive from Yuma, Arizona, to San Diego, California—a milestone for autonomous trucking in the U.S. This feat was achieved by the company TuSimple, which trained its driving system using an AI technique known as deep learning to simulate tens of millions of miles of road driving.

Let's get <u>you</u> started

Selected customers running AI on AWS

Questions, questions…

- What's <u>the</u> business problem my IT has failed to solve?
  - That's probably where Deep Learning can help
- Should I design and train my own Deep Learning model?
  - Do I have the expertise?
  - Do I have enough time, data & compute to train it?
- Should I use a pre-trained model?
  - How well does it fit my use case?
  - On what data was it trained? How close is this to my own data?
- Should I use a SaaS solution?
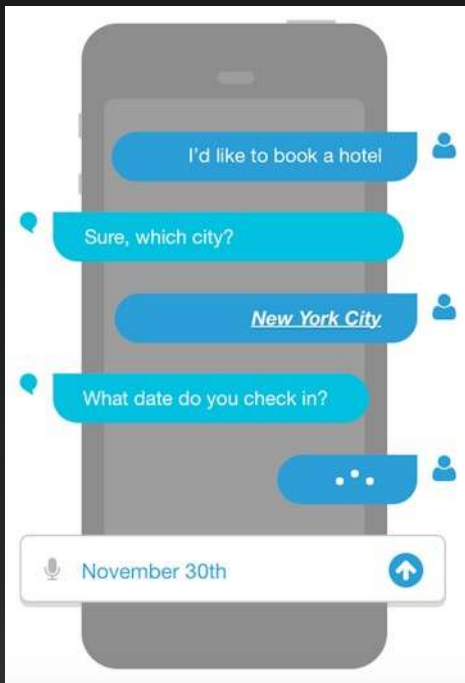- Same questions as "Big Data" years ago!

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Amazon AI for every developer

Services	**Chat** Amazon Lex	**Speech** Amazon Polly	**Vision** Amazon Rekognition
Platforms	Amazon ML · Spark & EMR	Kinesis	Batch · ECS
Engines	MXNet · TensorFlow · Caffe	Theano	Pytorch · CNTK
Infrastructure	GPU · CPU	IoT	Mobile

More information at aws.amazon.com/ai

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Amazon Lex

BookHotel

Intents
An Intent performs an action in response to natural language user input
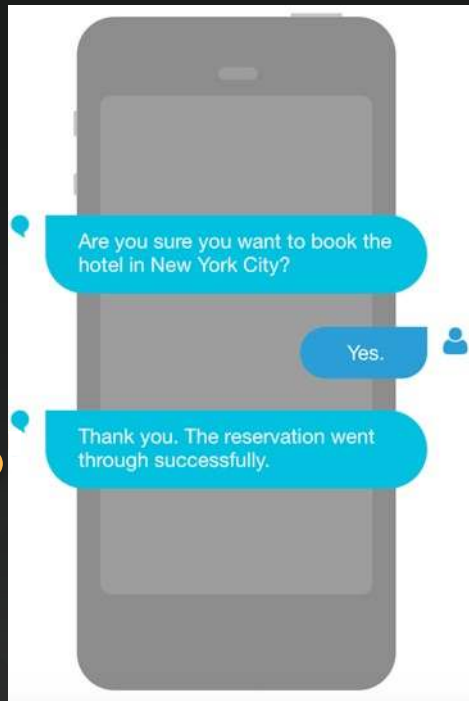
Utterances
Spoken or typed phrases that invoke your intent

Slots
Slots are input data required to fulfill the intent
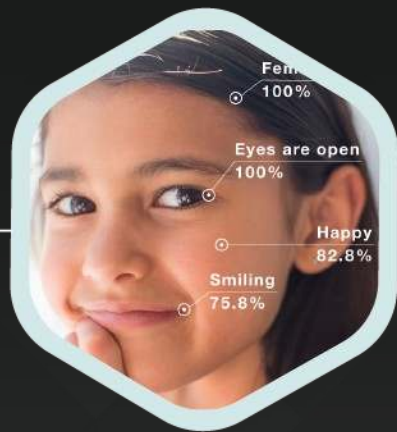
Fulfillment
Fulfillment mechanism for your intent

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Amazon Polly

- A service that converts text

  into lifelike speech

- Offers 48 voices across 24 languages

- Low latency enable developers to build real-time systems

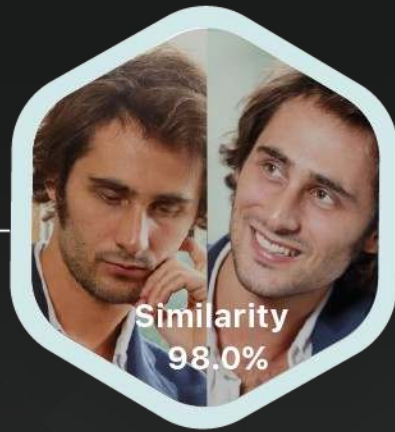- Developers can store, replay and distribute generated

  speech

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Amazon Rekognition

Object and Scene Detection

Facial Analysis

Face Comparison

Facial Recognition

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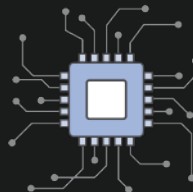# Apache MXNet: Open Source library for Deep Learning

Programmable
Simple syntax,
multiple languages

Portable
Highly efficient
models for mobile
and IoT

High Performance
Near linear scaling
across hundreds of GPUs

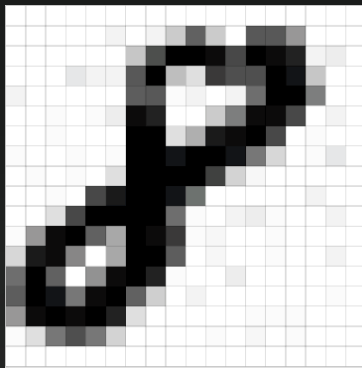## Most Open
Accepted into the
Apache Incubator

Best On AWS
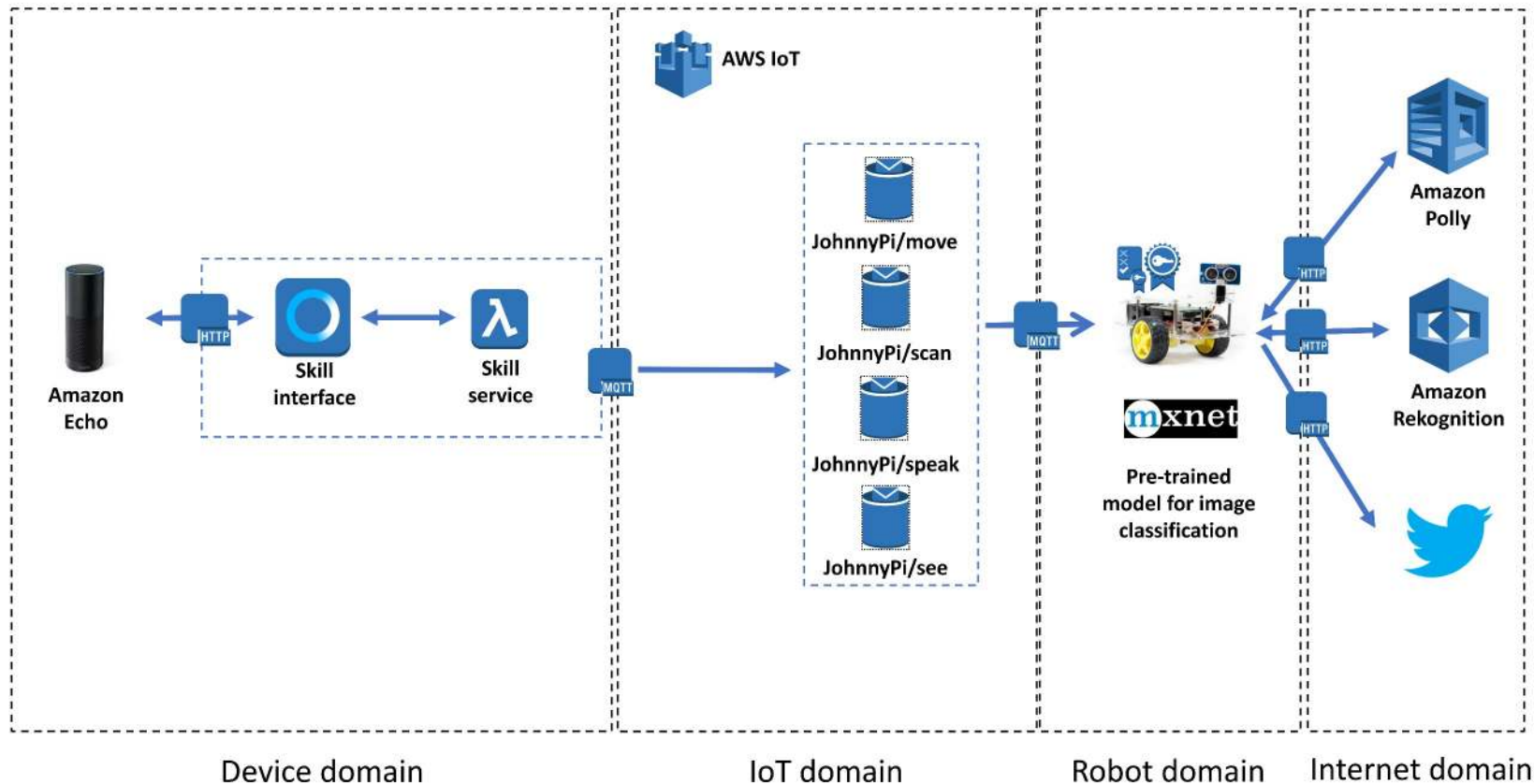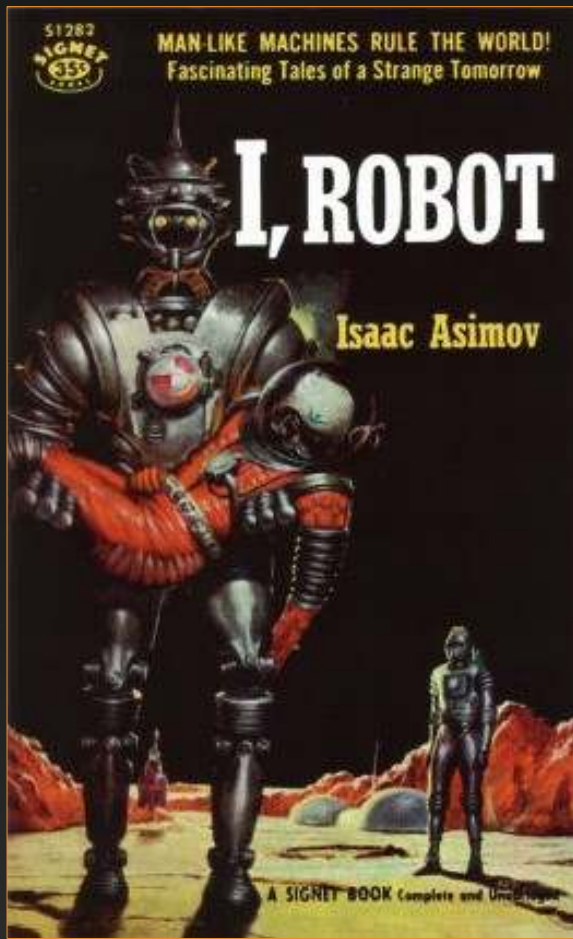Optimized for
Deep Learning on AWS

More information at
mxnet.io

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Demo #1: training MXNet on MNIST

Demo #2: putting it all together

Device domain · IoT domain · Robot domain · Internet domain

Will machines learn how to understand humans – not the other way around?

Will they help humans understand each other?

Will they end up ruling the world?

Who knows?

Whatever happens, these will be fascinating tales of our strange tomorrow.

Thank you
@julsimon