



AI & ML: State of the Union

Julien Simon

Principal AI/ML Evangelist, Amazon Web Services

@julsimon



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Amazon.com, 1995

« Two Decades of Recommender Systems at Amazon.com » (2017)



G.D. Linden, J.A. Jacobi, and E.A. Benson,
Collaborative Recommendations Using
Item-to-Item Similarity Mappings, US
Patent 6,266,649, to Amazon.com, Patent
and Trademark Office, 2001 (filed **1998**).

<https://www.computer.org/csdl/mags/ic/2017/03/mic2017030012.html>



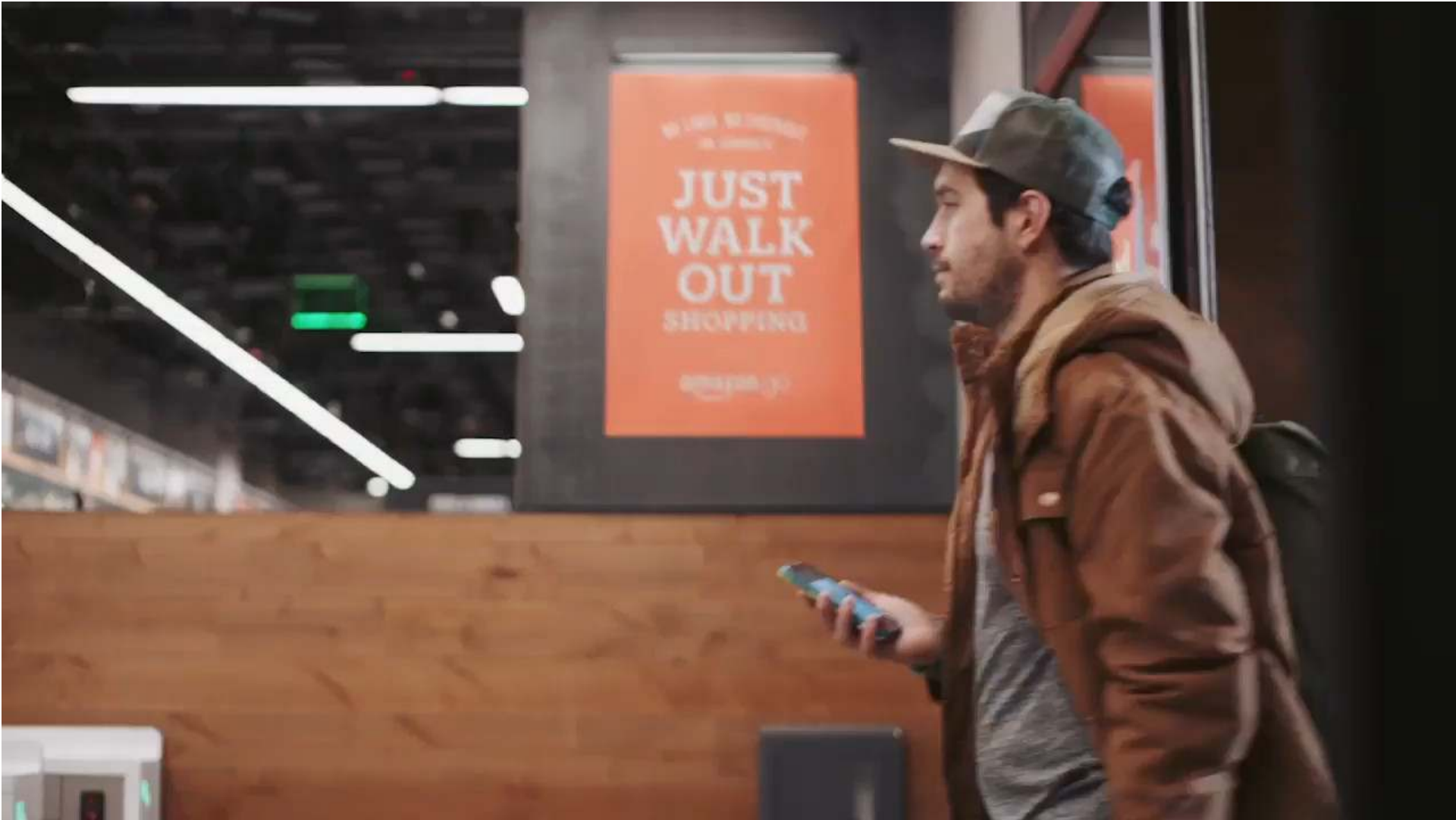
amazonrobotics

amazon echo





amazon



Our mission

**Put Machine Learning in the hands of every
developer and data scientist**

AWS ML Stack

Application Services

API-driven services: Vision & Language Services, Conversational Chatbots

Platform Services

Deploy machine learning models with high-performance machine learning algorithms, broad framework support, and one-click training, tuning, and inference.

Frameworks & Infrastructure

Develop sophisticated models with any framework, create managed, auto-scaling clusters of GPUs for large scale training, or run inference on trained models.

More AI/ML is built on AWS than anywhere else



More AI/ML is built on AWS than anywhere else



Application Services

Amazon Rekognition

Deep Learning-based image analysis service

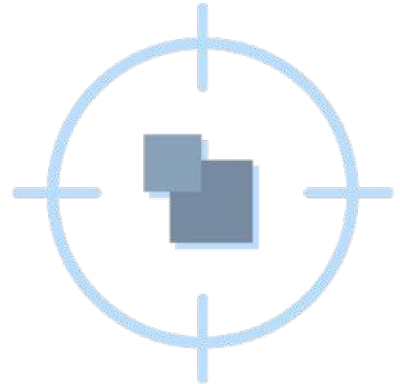
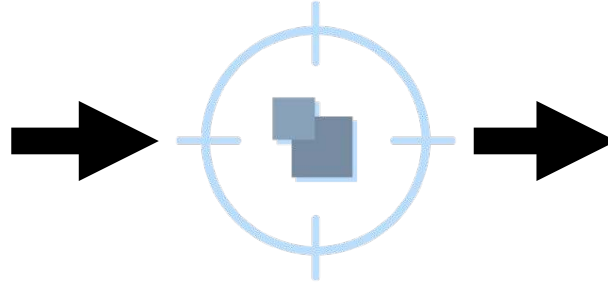


Image analysis service



Amazon
Rekognition

Object and scene detection
Facial analysis
Face comparison
Celebrity recognition
Image moderation
Text in image

Object & Scene Detection



City	91.4%
Downtown	91.4%
Metropolis	91.4%
Urban	91.4%
Building	56.2%
High Rise	56.2%
Dock	55.6%
Pier	55.6%
Dawn	52.4%
Dusk	52.4%

Facial Analysis



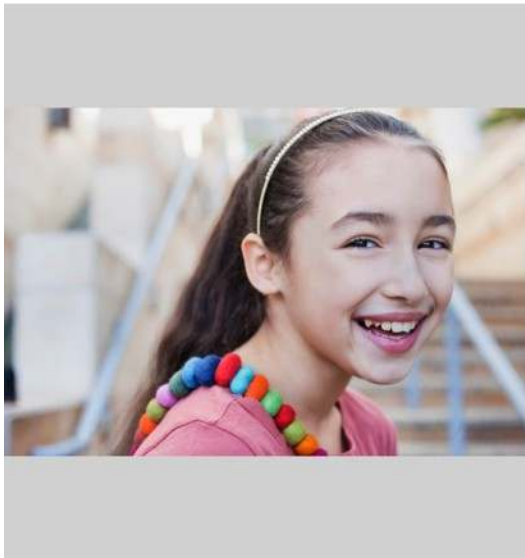
looks like a face	99.8%
appears to be female	100%
age range	23 - 38 years old
smiling	99.4%
appears to be happy	93.2%
wearing eyeglasses	99.9%
wearing sunglasses	97.6%

Crowd Detection – up to 100 faces

NEW



Facial Search



=



Similarity

97%



≠



≠



Image Moderation



▼ Results

Suggestive	83.5%
Female Swimwear Or Underwear	83.5%

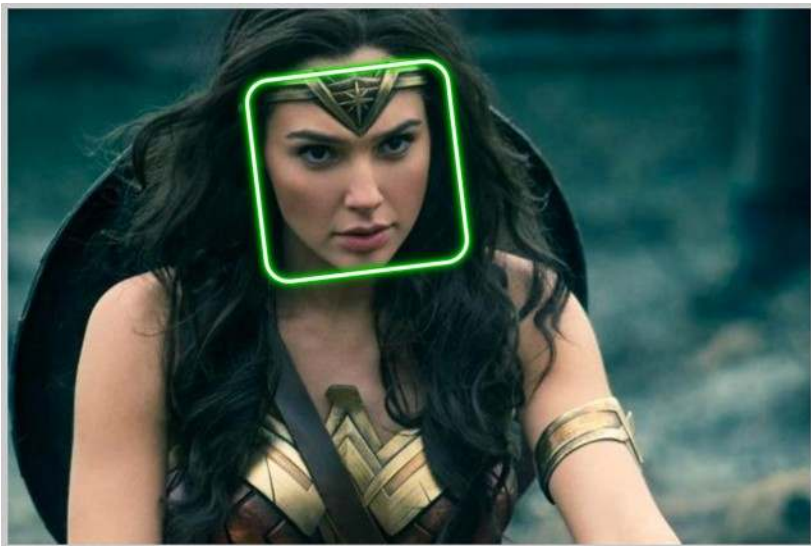
Explicit Nudity

- Nudity
- Graphic Male Nudity
- Graphic Female Nudity
- Sexual Activity
- Partial Nudity

Suggestive

- Female Swimwear or Underwear
- Male Swimwear or Underwear
- Revealing Clothes

Celebrity Recognition



▼ Results



Gal Gadot
[Learn More](#)

Match confidence

100%

Text in Image

NEW



▼ Results

US English only

| 5T6E652 |

► Request

▼ Response

```
{
  "TextDetections": [
    {
      "Confidence": 96.38984680175781,
      "DetectedText": "5T6E652",
      "Geometry": {
        "BoundingBox": {
          "Height": 0.05606506019830704,
          "Left": 0.38905566930770874,
          "Top": 0.7383729219436646,
          "Width": 0.10844030976295471
        },
        "Polygon": [
          {
            "X": 0.38905566930770874,
            "Y": 0.7383729219436646
          },
          {
            "X": 0.49749597907066345,
            "Y": 0.7726403474807739
          },
          {
            "X": 0.4896218776702881,
            "Y": 0.8287054300308228
          },
          {
            "X": 0.38905566930770874,
            "Y": 0.7383729219436646
          }
        ]
      }
    }
  ]
}
```

Marinus Analytics

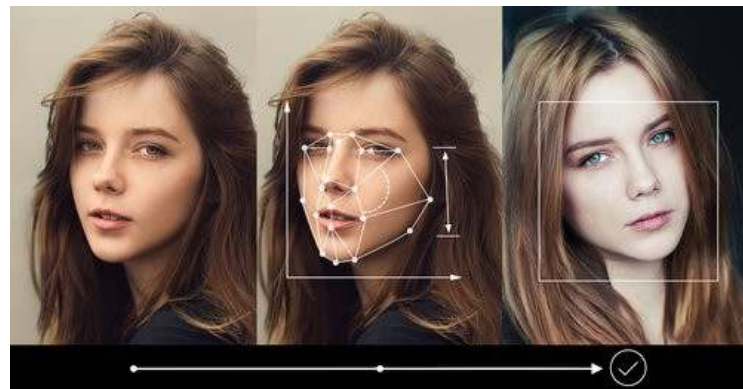


Marinus Analytics provides law enforcement with tools founded in artificial intelligence.

Traffic Jam, is a suite of tools for use by law enforcement agencies on sex trafficking investigations.

Before using **Amazon Rekognition**, their only recourse was manual processing; this was time-intensive or not possible.

Now, investigators are able to take effective action by searching through **millions of records in seconds** to find victims.

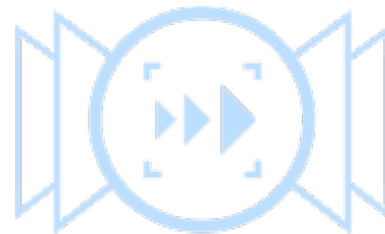


<http://www.marinusanalytics.com/articles/2017/10/17/amazon-rekognition-helps-marinus-analytics-fight-human-trafficking>

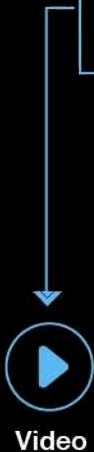
NEW

Amazon Rekognition Video

Deep Learning-based video analysis service



Video Analysis



Rekognition

Context

Spatial

Temporal

Auditory

Features

Objects, Scenes and Concepts



Facial Analysis



Female: 99.9%
Eyes are open: 98.4%
Calm: 86.0%

Face Recognition



Person 1

Activity Detection

Sports, Running

Object Tracking



Results

Here are the results we found sorted by category. The marks on the timeline show where we found results that are selected.

57

All results

1

People

0

Celebrities

56

Objects and activities

0

Moderated labels

Q Search

☐ Select all

▼ Objects and activities

Sunset Nature Outdoors Mountain Sky

Mountain Range Crest Sunrise Dawn Dusk Red Sky

Water Promontory Ocean Sea Sea Waves Fire

Campfire Flame Bonfire Camping Leisure Activities

Rock Person

[Show more](#)

▼ Download response

Download response as JSON file



<http://timescapes.org/trailers/>


Results

Here are the results we found sorted by category. The marks on the timeline show where we found results that are selected.

57 All results	1 People	0 Celebrities	56 Objects and activities	0 Moderated labels
-------------------	-------------	------------------	------------------------------	-----------------------

☐ Select all

▼ People



Person: 7


▼ Download response

Download response as JSON file

⏮

0:44

⏭



0:44 / 0:47

⏮

Real-time video analysis

*"The City of Orlando is excited to work with Amazon to pilot the latest in public safety software through a unique, first-of-it's-kind public-private partnership. Through the pilot, Orlando will utilize **Amazon Rekognition Video** and **Amazon Kinesis Video Streams** technology in a way that will use existing City resources to provide real-time detection and notification of persons-of-interests, further increasing public safety, and operational efficiency opportunities for the City of Orlando and other cities across the nation".*



John Mina, Police Chief, City of Orlando

Amazon Polly

Deep Learning-based text-to-speech service

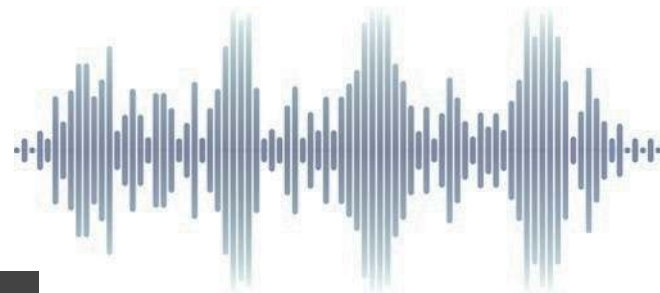
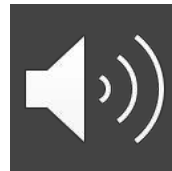


Amazon Polly: Text In, Life-like Speech Out

“Hejsan! Jag heter Astrid och läser upp det som skrivs här.”



Amazon Polly



A Focus On Voice Quality & Pronunciation

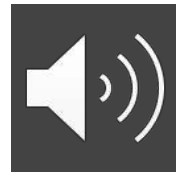
Support for Speech Synthesis Markup Language (SSML) Version 1.0

<https://www.w3.org/TR/speech-synthesis>

```
<speaking xml:lang="en-US">
```

The price of this book is **<prosody rate="60%">45€</prosody>**

```
</speaking>
```



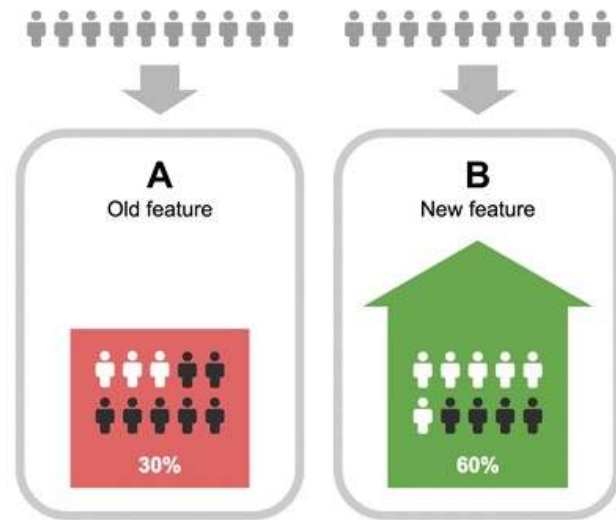
Duolingo



Duolingo is the most popular language-learning platform and the most downloaded education app in the world, with more than **170 million users**.

They have run six A/B tests, testing an **Amazon Polly** voice against a voice from other TTS providers.

For all of these experiments, the winning condition was the Amazon Polly voice



<https://aws.amazon.com/blogs/machine-learning/powering-language-learning-on-duolingo-with-amazon-polly/>

NEW

Amazon Translate

Neural Machine Translation Service

(Preview)

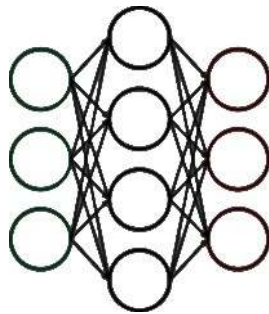


Amazon Translate

Natural and fluent language translation



Real-time translation



Powered by Deep
Learning



12 Language pairs
(more to come)



Language detection

Machine Translation

« At Hotels.com, we are committed to offering all of our customers the most relevant and up to date information about their destination. To achieve that, we operate **90 localized websites in 41 languages**. We have more than **25M customer reviews** and more are coming in every day, making a great candidate for machine translation. Having evaluated Amazon Translate and several other solutions, we believe that **Amazon Translate** presents **a quick, efficient and most importantly, accurate solution** »

Matt Fryer, VP and Chief Data Science Officer, Hotels.com

NEW

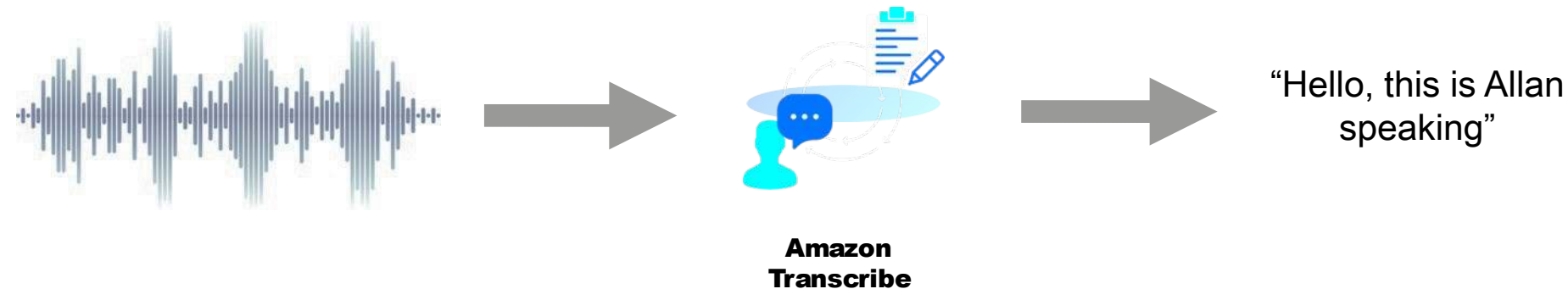
Amazon Transcribe

Automatic speech recognition service

(Preview)



Automatic speech recognition service



Automatic speech recognition service



Multiple
languages



Intelligent
punctuation
and formatting



Timestamp
generation



Support for
telephony
audio



Recognize
multiple
speakers



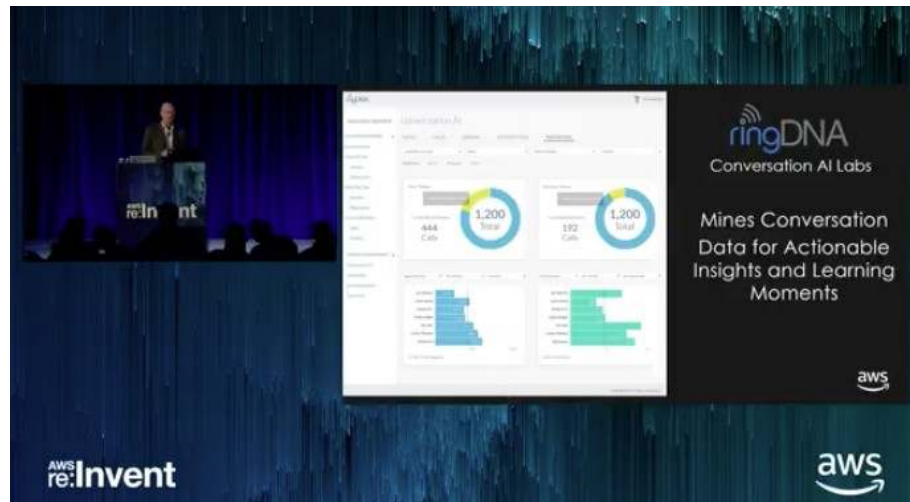
Custom
vocabulary

RingDNA is an end-to-end communications platform for sales teams. Hundreds of enterprise organizations use RingDNA to increase productivity, engage in smarter sales conversations, gain predictive sales insights and improve their win rate.

Speech to Text

*"A critical component of RingDNA's Conversation AI requires best of breed speech-to-text to deliver transcriptions of every phone call. RingDNA is excited about **Amazon Transcribe** since it provides high-quality speech recognition at scale, helping us to better transcribe every call to text"*

Howard Brown, CEO & Founder, RingDNA

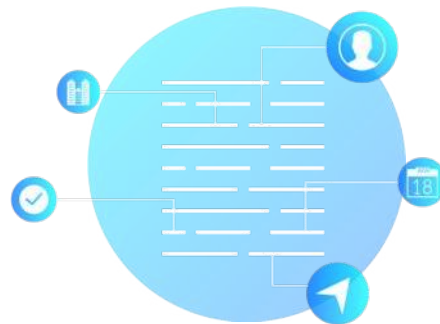


https://www.youtube.com/watch?v=1ZJ_f1bDdog

NEW

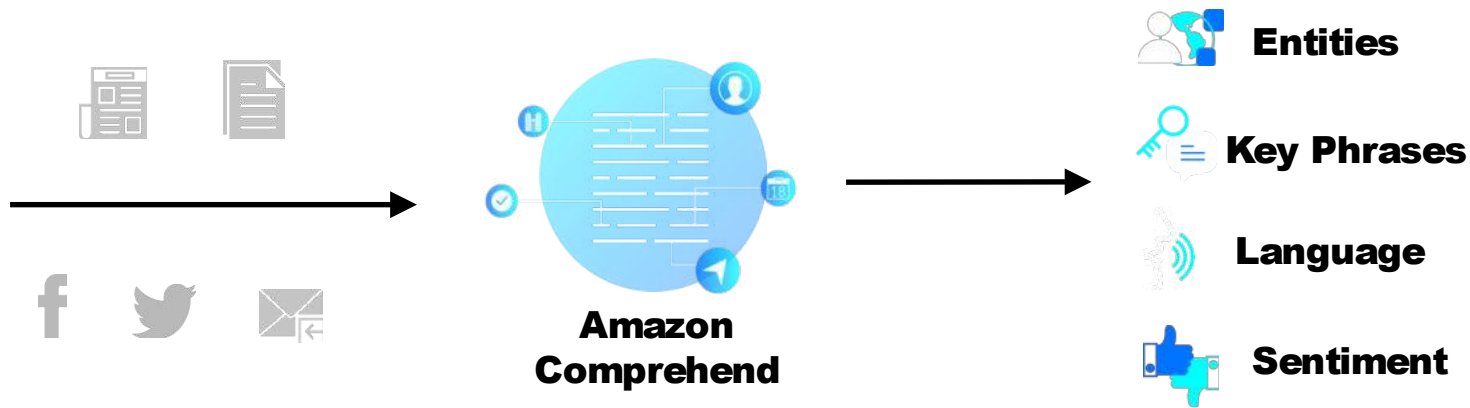
Amazon Comprehend

Natural Language Processing



Fully managed natural language processing

Discover valuable insights from text



API explorer

Paste the text that you would like to analyze with natural language processing.

[Clear text](#)

The accompanying shots from the **Newcastle Herald**'s award-winning team of photographers are worth **more than 1000 words** apiece. But that's the maximum number of words you will require to have a shot at winning the **Herald's sixth annual short story competition**. It's time to let your inner author off the leash and **allow** your imagination to run wild. Stories can be of any genre but must be your own work. The plot must draw inspiration in some way from **one** of these **four images**. Herald photographers **Simone De Peak**, **Marina Neil**, **Jonathan Carroll** and **Max Mason-Hubers** captured the evocative pictures. Stories submitted for the competition must be between **900** and **1000 words**. Judges include **Newcastle Writers Festival** director **Rosemarie Milsom**, **Herald** deputy editor **Matt Carr**, **Hunter Writers Centre** director **Karen Crofts** and president **Megan Buxton**, and **Fairfax Media's** **Newcastle-Hunter** group managing editor **Chad Watson**.

4

916 of 1000 characters used

Language English

[Analyze](#)

Entity

This API returns the named entities ("Person", "Organization", "Locations", etc.) within the text you analyzed.

[List](#) [Tiles](#) [JSON](#) [Filter](#) Show all categories

Entity	Category	Count	Confidence
Newcastle Herald	Organization	1	0.89
more than 1000 words	Quantity	1	0.91
Herald	Organization	2	0.46
sixth annual short story competition	Quantity	1	0.79
one	Quantity	1	0.4
four images	Quantity	1	0.96
Simone De Peak	Person	1	0.99
Marina Neil	Person	1	0.99+
Jonathan Carroll	Person	1	0.99+
Max Mason-Hubers	Person	1	0.99
900	Quantity	1	0.99

[Show all](#)

Topic modeling



**Amazon
Comprehend**

STORM



WORLD
SERIES



STOCK
MARKET



WASHINGTON



AUSTRALIA HEALTH



CRISIS



MACHINE
LEARNING



Topic modeling

Amazon Comprehend will manage the lifetime on your completed topic detection jobs. Completed jobs are cleaned up periodically. The results from successfully completed jobs are persisted indefinitely, until you choose to remove them.

Create

↺ ?

viewing 1 to 1 items

Job name	Job ID	Start time	End time	Status
TopicModelJob	346f527bbd09fb370be7e9f46ad7d249	11/12/2017, 22:34:29	11/12/2017, 22:42:38	Completed

Job info

Job name	TopicModelJob
Job ID	346f527bbd09fb370be7e9f46ad7d249
Analysis type	Topic modeling
Number of topics	10
Start time	11 Dec 2017 20:34:29 GMT
End time	11 Dec 2017 20:42:38 GMT
Status	COMPLETED
Job information	--

Actions

Input data location	s3://public-sample-us-east-1
Output data location	s3://adhorn-topicmodeling-output/322549714802-346f527bbd09fb370be7e9f46ad7d249-1513024469818/output/output.tar.gz

ClearView Social



CLEAR
VIEW
SOCIAL

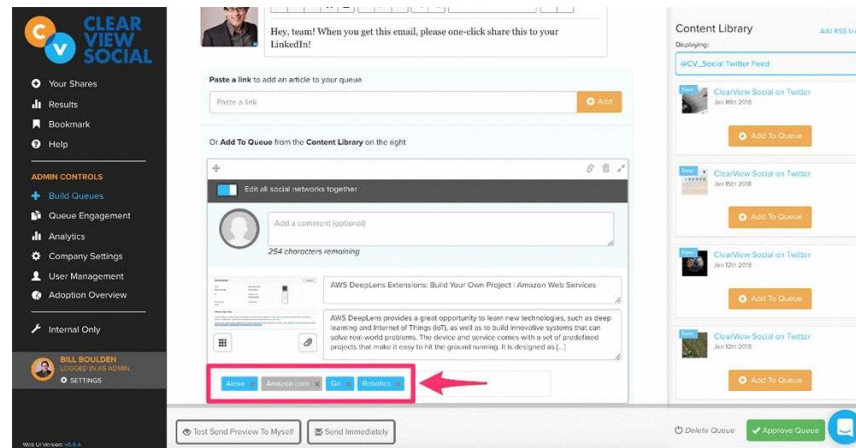
ClearView Social enables a company's employees to share approved content on LinkedIn, Twitter, and other social networks.

To eliminate the reliance on manual tagging, ClearView Social turned to **Amazon Comprehend** to find **insights** and **relationships** in text.

Natural Language Processing

"We use **Amazon Comprehend** to read an article and extract topics, which are automatically tagged using machine learning. This automatic tagging helps customers easily estimate the market value of their engagement according to the current bid prices from the Google AdWords API"

Bill Boulden, CTO, ClearView Social



<https://aws.amazon.com/blogs/machine-learning/clearview-social-uses-amazon-comprehend-to-measure-the-impact-of-social-sharing/>

Amazon Lex

Conversational Interfaces



BookHotel

Intents

A particular goal that the user wants to achieve

Utterances

Spoken or typed phrases that invoke your intent

Slots

Data the user must provide to fulfill the intent

Prompts

Questions that ask the user to input data

Fulfillment

The business logic required to fulfill the user's intent



I'd like to book a hotel.

Sure, which city?

New York City

What date do you check in?



November 30th.

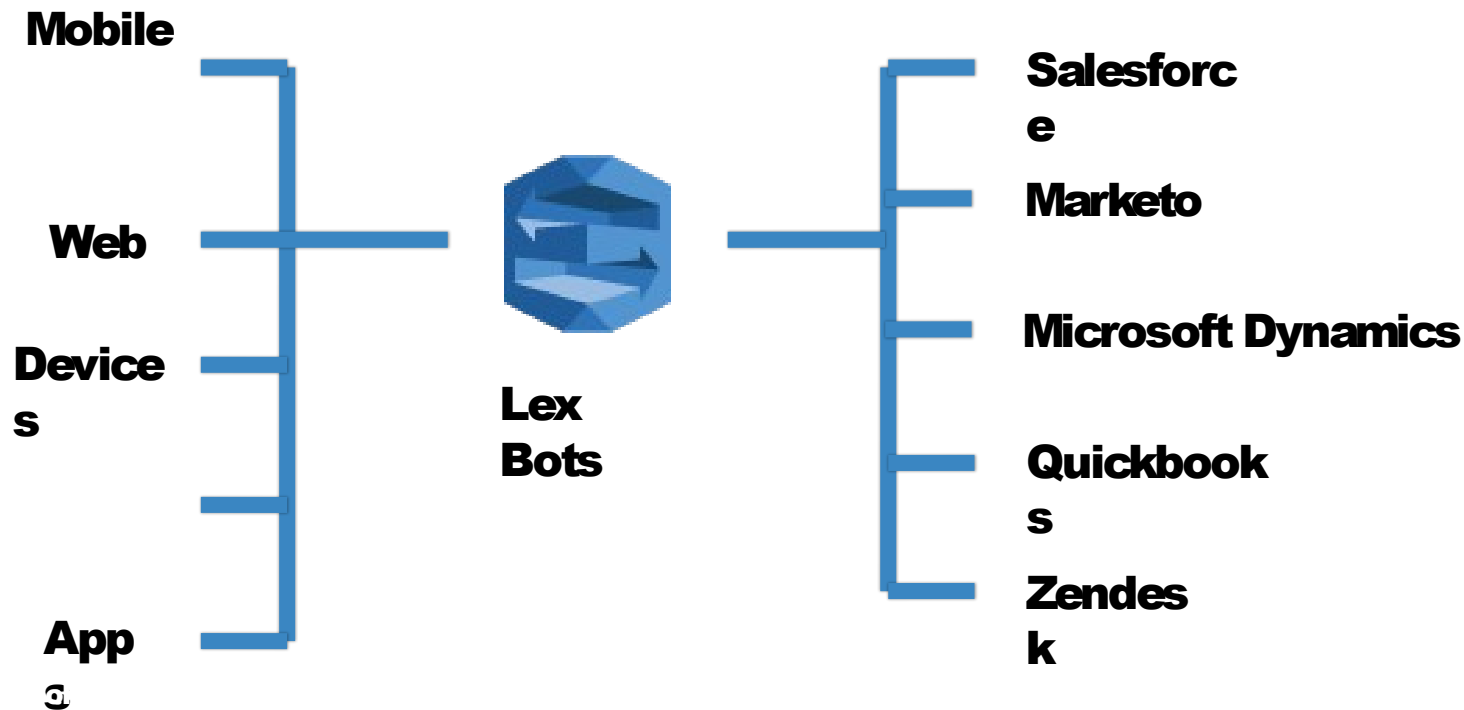


Are you sure you want to book the hotel in New York City?

Yes.

Thank you. The reservation went through successfully.

Amazon Lex: Conversational Chatbots



Chatbots

« With the growing importance of cognitive technologies in every area of business, we were delighted to see **Amazon Lex**, with its Speech Recognition and Natural Language Understanding technologies, added to the broad portfolio of services AWS provides. Amazon Lex **integrates easily** into our existing applications, as well as our new cloud-native serverless architectures. »

Gillian Armstrong, Technologist, Liberty Mutual



https://www.youtube.com/watch?v=TeLvFqLW_0A

Platform Services

ML on Amazon Elastic Map Reduce



**Amazon
EMR**



Spark 1.2.2

[Overview](#)

[Programming Guides](#)

[API Docs](#)

[Deploying](#)

[More](#)

Machine Learning Library (MLlib) Programming Guide

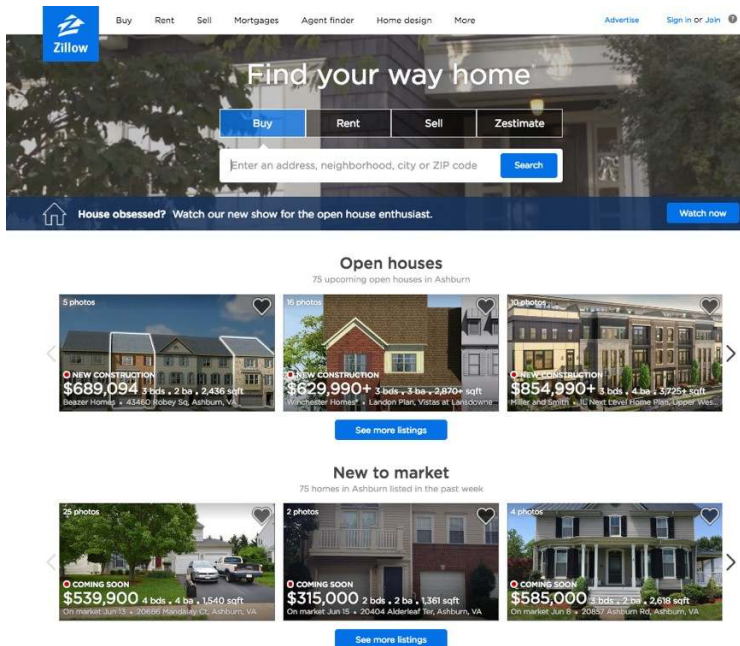
MLlib is Spark's scalable machine learning library consisting of common learning algorithms and utilities, including classification, regression, clustering, collaborative filtering, dimensionality reduction, as well as underlying optimization primitives, as outlined below:

- [Data types](#)
- [Basic statistics](#)
 - summary statistics
 - correlations
 - stratified sampling
 - hypothesis testing
 - random data generation
- [Classification and regression](#)
 - [linear models](#) (SVMs, logistic regression, linear regression)
 - [naive Bayes](#)
 - [decision trees](#)
 - [ensembles of trees](#) (Random Forests and Gradient-Boosted Trees)
- [Collaborative filtering](#)
 - alternating least squares (ALS)
- [Clustering](#)
 - k-means
- [Dimensionality reduction](#)
 - singular value decomposition (SVD)
 - principal component analysis (PCA)
- [Feature extraction and transformation](#)
- [Optimization \(developer\)](#)
 - stochastic gradient descent
 - limited-memory BFGS (L-BFGS)

MLlib is under active development. The APIs marked `ExperimentalDeveloperApi` may change in future releases, and the migration guide below will explain all changes between releases.



- Zillow Group uses Machine Learning to deliver **near-real-time home-valuation** data to customers using AWS.
- The company houses a portfolio of the largest online real-estate and home-related brands.
- Zillow Group runs the Zestimate, its machine learning–based home-valuation tool, on **Amazon Kinesis** and **Apache Spark** on **Amazon EMR**.



<https://aws.amazon.com/solutions/case-study/zillow-zestimate/>

Amazon SageMaker

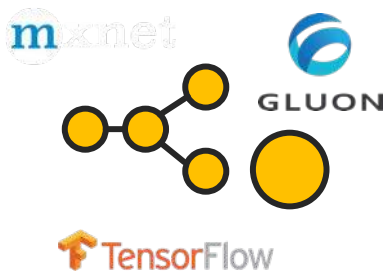
Build, train, and deploy machine learning models at scale



End-to-End
Machine Learning
Platform



Zero setup



Flexible Model
Training



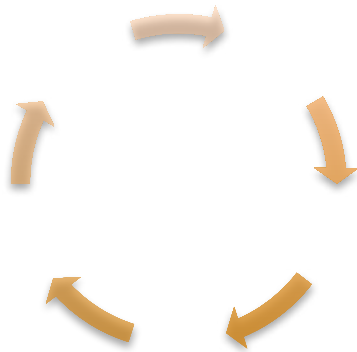
Pay by the second

Amazon SageMaker

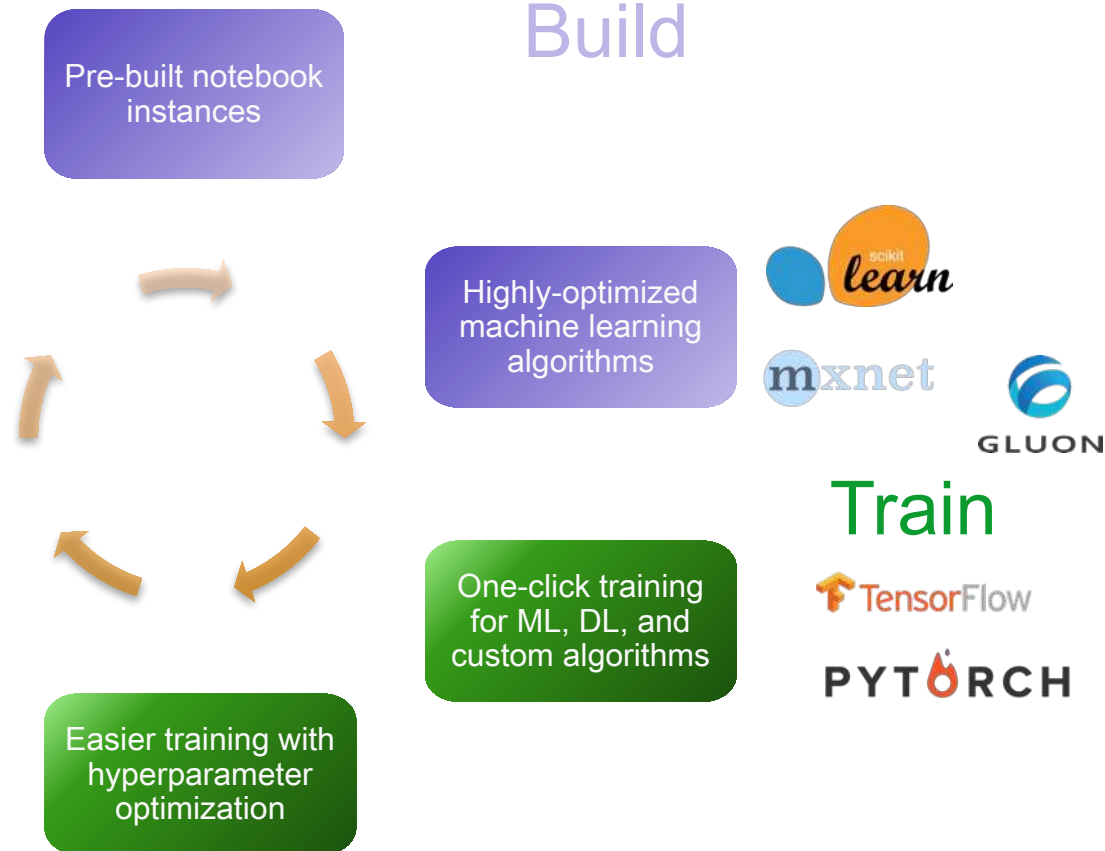
Pre-built notebook
instances

Build

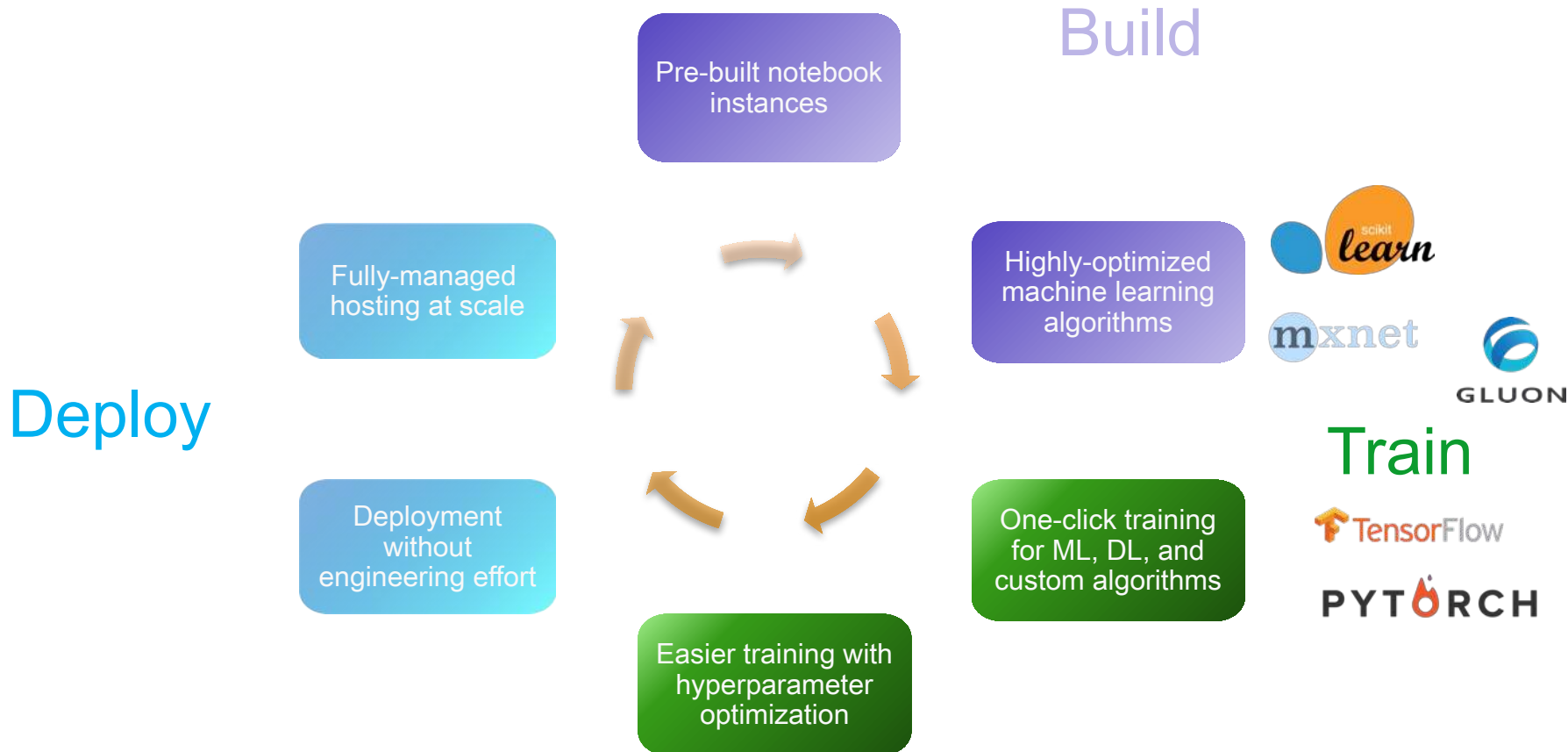
Highly-optimized
machine learning
algorithms



Amazon SageMaker



Amazon SageMaker



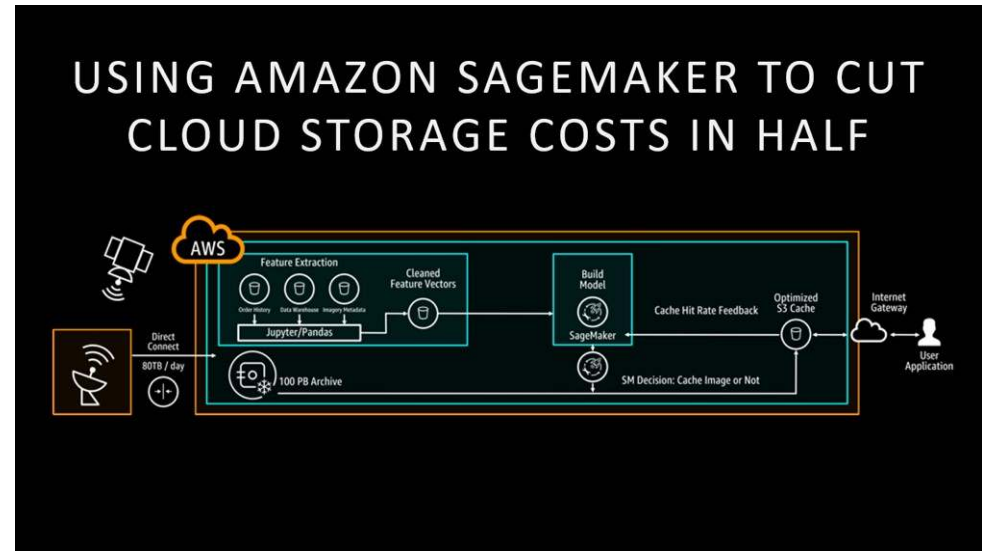
Digital Globe



In the last 18 years DigitalGlobe has been operating Earth imaging satellites, they have collected over 100 PB of imagery.

There is a trade-off between how quickly data can be accessed and how much it will cost to store.

Working with the ML Lab, Digital Globe built a predictive model that will reduce cloud storage costs for their imagery archive by 50%.



<http://blog.digitalglobe.com/industry/using-machine-learning-to-save-money-on-cloud-data-storage/>

<https://www.youtube.com/watch?v=mkKkSRlxU8M>

Amazon ML Lab



Lots of companies
doing Machine
Learning



Lack ML
expertise



Unable to unlock
business potential

Amazon ML Lab
provides the missing
ML expertise



Leverage Amazon experts with decades of ML
experience with technologies like Amazon Echo,
Amazon Alexa, Prime Air and Amazon Go



Brainstorming



Modeling



Teaching

Frameworks & Infrastructure

Amazon EC2 P3 Instances

The fastest, most powerful GPU instances in the cloud

- Up to eight NVIDIA Tesla V100 GPUs
- 1 PetaFLOPs of computational performance
 - *14x better than P2*
- 300 GB/s GPU-to-GPU communication (NVLink) – *9x better than P2*
- 16GB GPU memory with 900 GB/sec peak GPU memory bandwidth



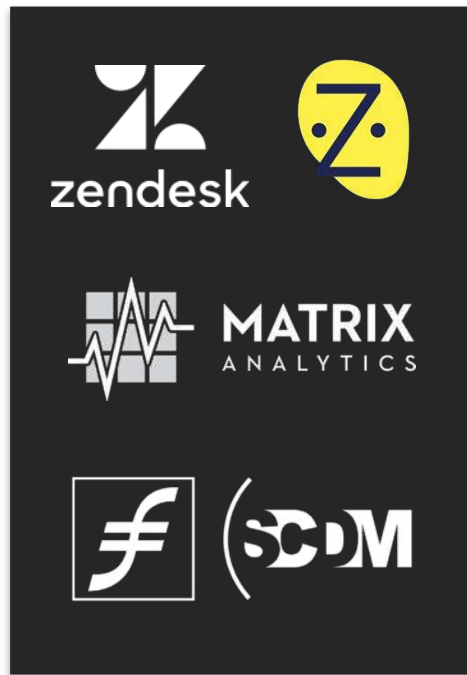
AWS Deep Learning AMI

- Easy-to-launch tutorials
- Hassle-free setup and configuration
- Pay only for what you use
- Accelerate your model training and deployment
- Support for popular deep learning frameworks



GLUON

PYTORCH



NEW

AWS DeepLens

Deep Learning enabled video camera
for developers

(Pre-orders)



AWS DeepLens

World's first Deep Learning enabled video camera for developers



A new way to learn

Custom built for deep learning

Broad Framework Support

Deploy models from Amazon SageMaker

Integrated with AWS

Full programmable with AWS Lambda

Object detection with AWS DeepLens



Democratization of AI

APPLICATION SERVICES



**Amazon
Rekognition**



**Amazon
Polly**



**Amazon
Lex**

**Amazon
Comprehend**



**Amazon
Rekognition
Video**



**Amazon
Transcribe**



**Amazon
Translate**

PLATFORM SERVICES

**Amazon
SageMaker**

AWS DeepLens

Amazon EMR

FRAMEWORKS AND INTERFACES

**Deep
Learning AMI**

Apache
MXNet

Caffe2

CNTK

PyTorch

TensorFlow

Theano

Torch

Keras

Gluon

Thank you!

Julien Simon

Principal AI/ML Evangelist, Amazon Web Services

@julsimon