

Prague AWS User Group

Artificial Intelligence (Machine Learning) on AWS: How to Start

Vladimir Simek, Senior Solutions Architect, AWS
20th of September, 2018

Agenda

- Brief history of AI/ML
- AI/ML in Amazon
- AWS Services for AI/ML
- Demo + Q&A



A Brief History of AI

AI (1993 – 2017)



1997

2005

2011

2017



Skynet



Back to reality

At Amazon, we've been making investments in ML for the last 20 years...





At Amazon, we've been making investments in ML for the last 20 years...

Fulfilment
& Logistics



The image is a collage of three screenshots from the Amazon mobile app illustrating machine learning use cases:

- Top Left (Fulfilment & Logistics):** A photograph of a warehouse shelf with books, overlaid with the text "Fulfilment & Logistics".
- Top Right (Search & Discovery):** A "Related to items you've viewed" section showing book covers for "SURVIVING AI" by Calum Chace and "The Intelligent Web" by Joe Hempsell.
- Bottom (Product Recommendation):** A "Search & Discovery" section titled "or a night in" featuring movie posters for "STAR WARS REBELS", "ROGUE ONE: A STAR WARS STORY", and "PLAY STAR WARS BATTLEFRONT". Below this is a "New & Interesting Finds" section showing two colorful, curved plastic spoons.

www.amazon.com/Lean-Startup-Entrepreneurs-Continuous-Innovation/dp/0307887898/ref=sr_1_1?ie=UTF8&qid=1455532634&sr=8-1&keywords=lean+startup

The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses Hardcover – September 13, 2011

by Eric Ries • Author

4.5 out of 5 stars • 1,043 customer reviews

See all 4 formats and editions

Hardcover \$16.49 Paperback from \$13.23 Audible \$0.00

63 Used from \$9.92 15 Used from \$13.43 Free with your Audible trial
92 New from \$10.00 4 New from \$13.23

Most startups fail. But many of those failures are preventable. The Lean Startup is a new approach being adopted across the globe, changing the way companies are built and new products are launched.

Eric Ries defines a startup as an organization dedicated to creating something new under conditions of extreme uncertainty. This is just as true for one person in a garage or a group of seasoned professionals in a Fortune 500 boardroom. What they have in common is a mission to penetrate that fog of uncertainty to discover a successful path to a sustainable business.

The Lean Startup approach fosters companies that are both more capital efficient and that leverage human creativity more effectively. Inspired by lessons from lean manufacturing, it relies on "validated learning" to iteratively refine a product or service until it finds a market fit.

Read more

See the Best Books of the Month

Want to know our Editors' picks for the best books of the month? Browse Best Books of the Month, featuring our favorite new books in more than a dozen categories.

Frequently Bought Together

THE LEAN STARTUP + **ZERO ONE**

Total price: \$32.82

Add both to Cart Add both to List

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Zero to One: Notes on Startups, or How to Build the Future by Peter Thiel Hardcover \$16.33

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The Innovator's Dilemma
Value Proposition Design
THE HARDEST THING ABOUT HARD THINGS
How Any Startup Can Generate Customer Growth
Traction: How Any Startup Can Achieve Exponential Growth

The Four
Anthony Goulet
\$4.99

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Qty: 1 List Price: \$24.99
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Want it tomorrow, Feb. 16? Order within 12 hrs 7 mins and choose One-day Shipping at checkout.
Details

Ship to:
Select a shipping address:

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Add to List

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We'll buy it for \$4.42
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Trade in now

Have one to sell?
Sell on Amazon

The most significant story of our time.

The Four
Anthony Goulet
\$4.99

Page 1 of 10

At Amazon, we've been making investments in ML for the last 20 years...

Fulfilment
& Logistics



Related to items you've viewed [See more](#)

CALUM CHACE
SURVIVING
AI



THIN
STATISTICS

Star Wars: Episode V - The Empire Strikes Back

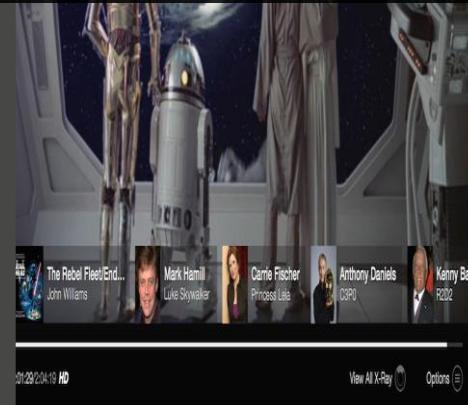
Search &
Discovery



New &
Interesting
Finds



Existing
Products



Carrier 3:32 PM 100% Book

Page Chapter Book Done

A Dance with Dragons: A Song of Ice... All (461) People (440) Terms (21)

- Daena
- Daenerys Targaryen**

'Queen Daenerys' - 'Dany' - 'Daenerys Stormborn' - 'The Unburnt' - 'Mother of Dragons' - 'Queen of Meereen' - 'Queen of the Andals and the Rhoynar and the First Men' - 'Khalasar of Great Grass Sea' - 'Breaker of Chains' - 15 years old; Sole heir to the Targaryen dynasty who ruled Westeros for 300 years u...
- Dagmer Cleftjaw
- Dagon Codd
- Dagon Greyjoy
- Dalla

Wildling Queen; Mance Raider's wife; Perished giving birth to Mance's son

- Damon

One of the Bastard's Boys; Is fair haired and boyish

- Daenel
- Danny Flint
- Dareon

Sworn Brother of the Night's Watch; A handsome young singer with fair hair and hazel eyes; Was sent to the Wall accused of rape but he has always claimed he is innocent; Was sent to Eastwatch after taking his vows; Jon & Sam's friend; Jon named him a recruiter to replace Yoren who vanished on his way to the wall; He will...

- Daryn Hornwood
- Davos Seaworth

Carrier 3:49 PM X-Ray Khal Drogo Done

Dany's "sun-and-stars" - Daenerys' deceased husband; A great khal of the Dothraki; Was never defeated in battle; Died of a wound that festered and was helped along by Mirri Maz Duur

From Shelfari.com



Chapter 2

They had been given to her when she wed Khal Drogo. It was Drogo who had given her the pelt she wore, the head and hide of a hrakkar, the white lion of the Dothraki sea.

Page 31 • Loc 648

Chapter 5

"That did not stop you selling her to Khal Drogo ..." "Dothraki neither buy nor sell. Say rather that her brother Viserys gave her to Drogo to win the khal's friendship.

Page 73 • Loc 1470

Chapter 23

"Bring the grey linen gown with the pearls on the

Star Wars: Episode V - The Empire Strikes Back



The Rebel Fleet/End...
John Williams



Mark Hamill
Luke Skywalker



Carrie Fisher
Princess Leia



Anthony Daniels
C3P0

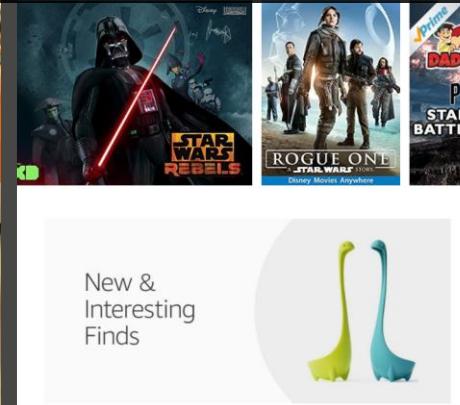


Kenny Baker
R2D2

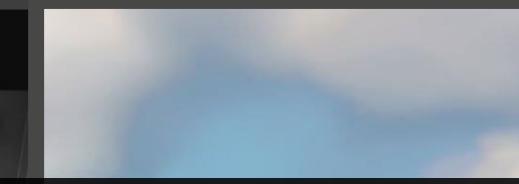
At Amazon, we've been making investments in ML for the last 20 years...



Fulfilment
& Logistics



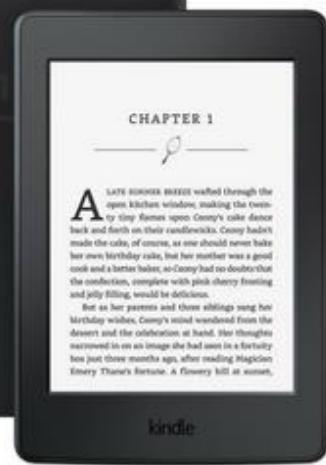
Existing
Products



New
Products







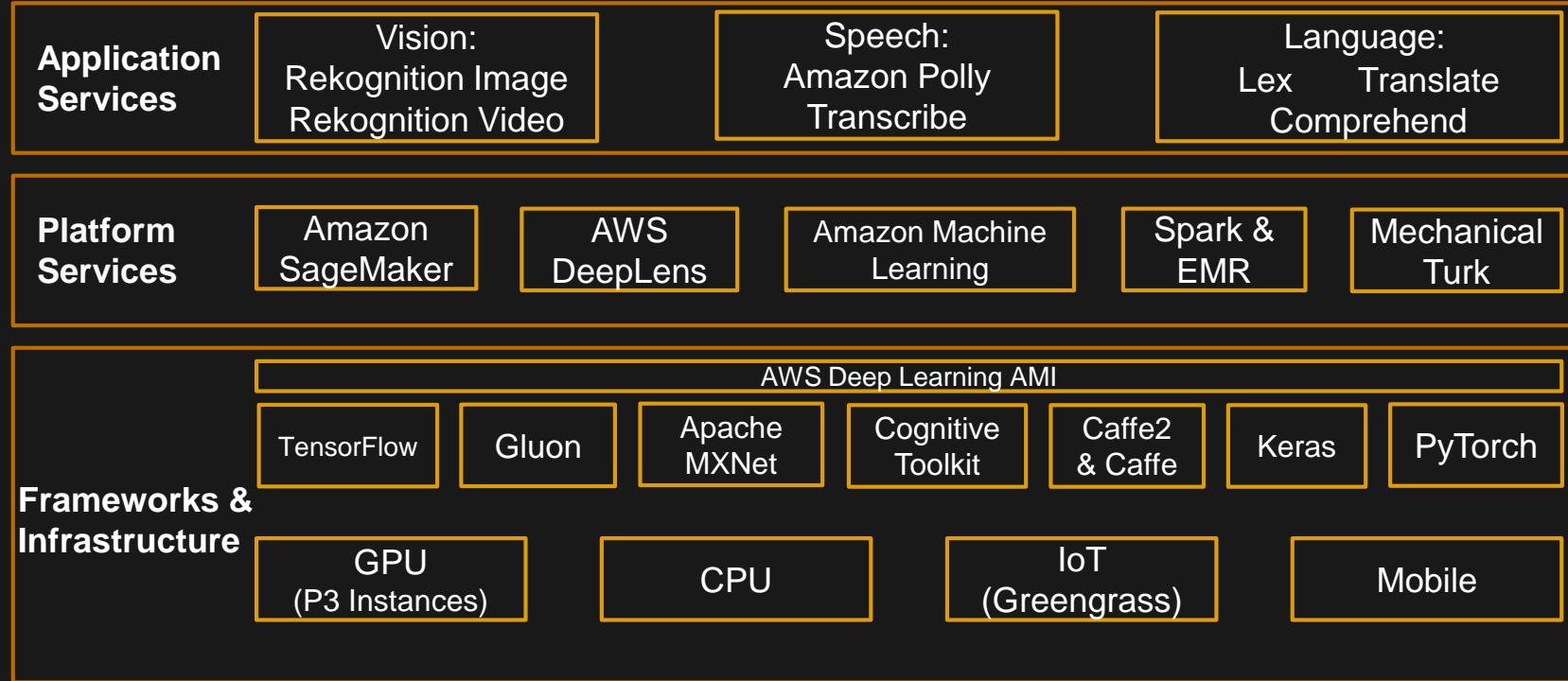
amazon go



ML @ AWS: Our mission

Put machine learning in the hands of every developer and data scientist

AWS ML Stack



CUSTOMERS RUNNING MACHINE LEARNING ON AWS TODAY



Mobilink

SmugMug

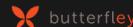


GoAnimate



WOLFRAM

butterflye



influicity



HubSpot



Openinfluence

gumgum[®]

SIGOPT



witlee



NVIDIA



twilio



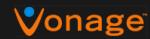
SHERIFF



Sturdy

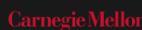


duolingo

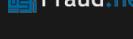
Vonage[®]

OpenAI

Carnegie Mellon



mapbox



Fraud.net



CapitalOne



FINRA



THE TAKE

intel[®]

slack



Zillow

Kelley Blue Book
THE TRUSTED RESOURCE

zendesk



NASA



clarifai

move[®]

Liberty Mutual.



C-SPAN

TRD
TOYOTA RACING DEVELOPMENT

Pinterest



STITCH FIX



UCLA



infor

MOTOROLA
SOLUTIONS

zmags

yelp[®]

OpenAI



iTranslate



Instacart



inhealthcare



RNIB



GO GIRL



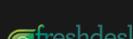
(f)

BeeLiked[®]
SOCIAL POLLINATION

OhioHealth



tu Simple



freshdesk



Mapillary

W
UNIVERSITY
OF
WASHINGTON

HYPR

JAM
CITYamazon
RAPIDS

Wizkids



Artfinder



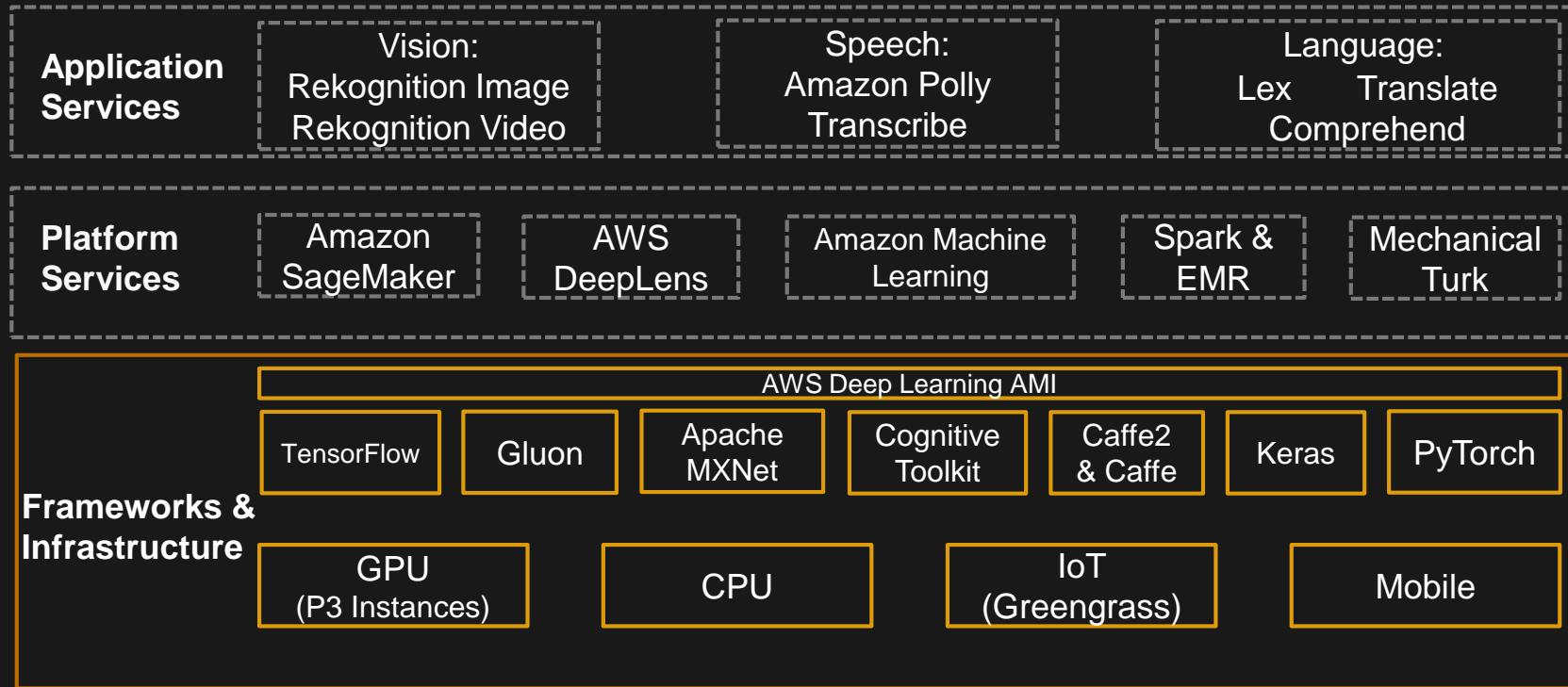
Zocdoc

American
Heart
Association.
Learn and Live

Storybulbs

aculabcloud
true cloud-based communication

AWS ML Stack



Amazon EC2 P3 Instances (October 2017)

The fastest, most powerful GPU instances in the cloud

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



AWS Deep Learning AMI

- Get started quickly with easy-to-launch tutorials
- Hassle-free setup and configuration
- Pay only for what you use – no additional charge for the AMI
- Accelerate your model training and deployment
- Support for popular deep learning frameworks



TensorFlow™

88% of TensorFlow projects in the cloud are running on AWS.

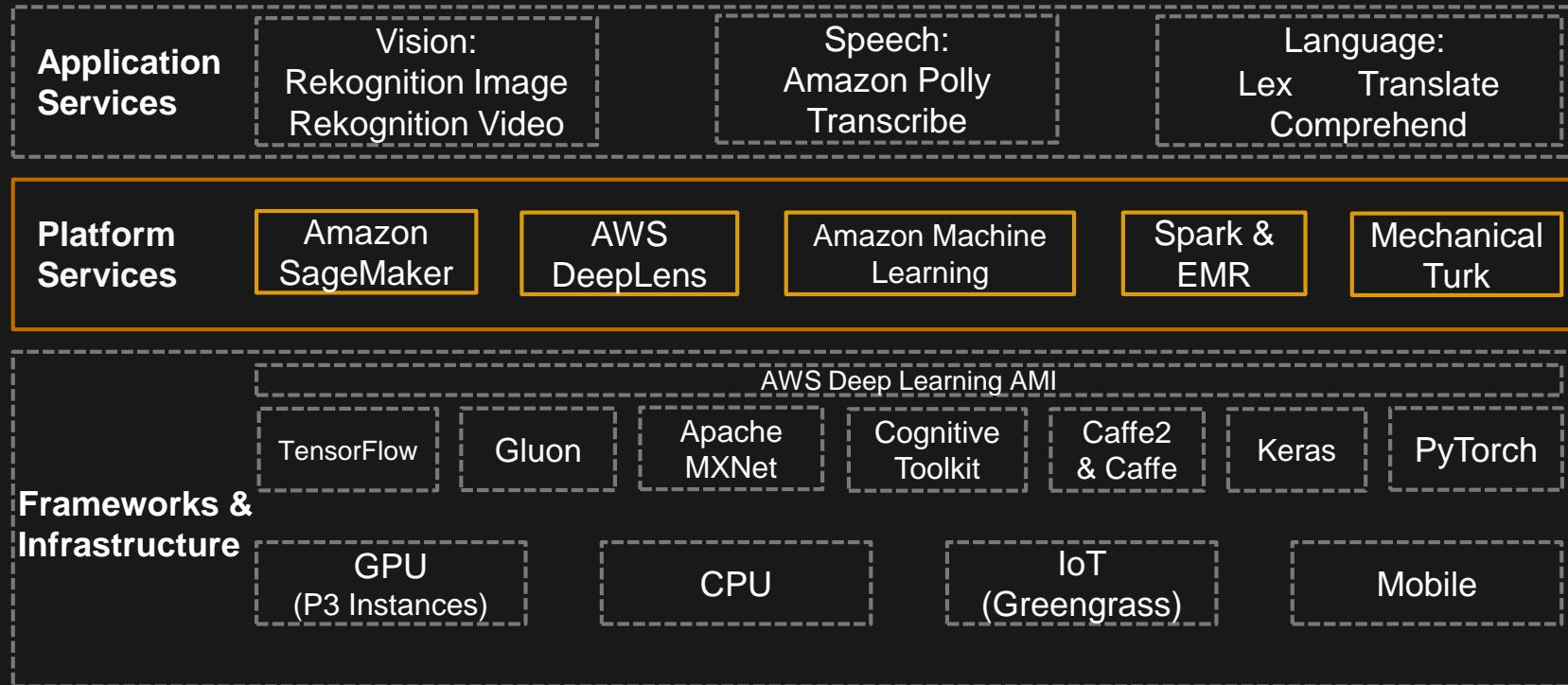
Nucleus Research reveals five reasons why deep learning practitioners choose AWS for deep learning over other cloud providers.

[Read the report](#)

https://d1.awsstatic.com/white_papers/nucleus-tensorflow.pdf



AWS ML Stack



How do we put ML in the hands of
developers (literally)?

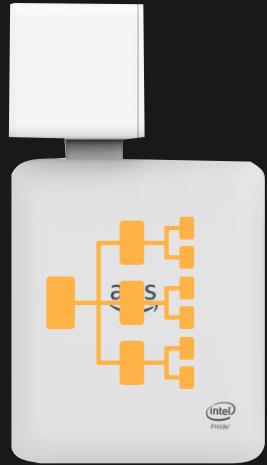


AWS DeepLens: A Deep Learning-Enabled Video Camera for Developers



- Fully programmable video camera
- Optimized for deep-learning on the device with Apache MXNet, Caffe, TensorFlow
- Tutorials, sample code, examples, and pre-built models

AWS DeepLens: How Does It Work?



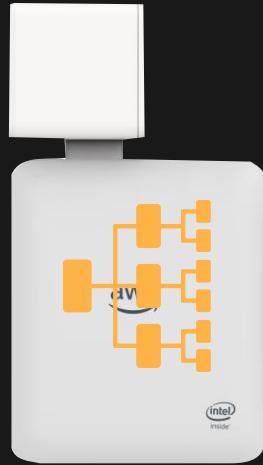
Deep learning models
run in real time on the device



Deploy pre-trained educational models

Deploy custom models from Amazon SageMaker

AWS DeepLens: How Does It Work?



Deep learning models
run in real time on the device



Stream live video back to AWS

Integrate with Lambda, SNS, SES, etc.

Video analytics with Amazon Rekognition Video



AWS DeepLens: Project Templates



Artistic Style Transfer



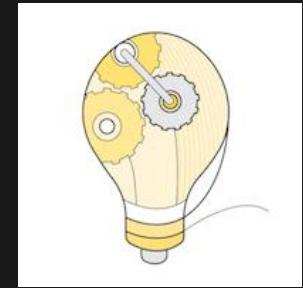
Hot Dog/Not Hot Dog Recognition



Object Recognition

Amazon Machine Learning

- Managed service for building ML models and generating predictions, enabling the development of robust, scalable smart applications
- No need for extensive background in ML algorithms and techniques
- Integrated with AWS (S3, Redshift, RDS)
- APIs for Batch and Real-Time Predictions
- Completely serverless



A (kind of) Demo – Titanic Survival

1 submissions for **vladsim**Sort by **Most recent** ▾**All** **Successful** **Selected**

Submission and Description

Public Score

Use for Final Score

[gender_submission_vlad2csv.csv](#)a minute ago by **vladsim**

Test #2 with AML

0.77990

[gender_submission_vlad.csv](#)a month ago by **vladsim**

A test done with Amazon Machine Learning service.

0.79425



THE SINKING OF THE RMS TITANIC IS ONE OF THE MOST INFAMOUS SHIPWRECKS IN HISTORY. ON APRIL 15, 1912, during her maiden voyage, the Titanic sank after colliding with an iceberg, killing 1502 out of 2224 passengers and crew. This sensational tragedy shocked the international community and led to better safety regulations for ships.

One of the reasons that the shipwreck led to such loss of life was that there were not enough lifeboats for the passengers and crew. Although there was some element of luck involved in surviving the sinking, some groups of people were more likely to survive than others, such as women, children, and the upper-

Amazon Mechanical Turk

- The first and foremost challenge in build AI systems is to build ground truth data
- Need human intelligence to annotate speech, vision, or language data sets



Mechanical Turk ML Customers



Facebook AI
Research (FAIR)



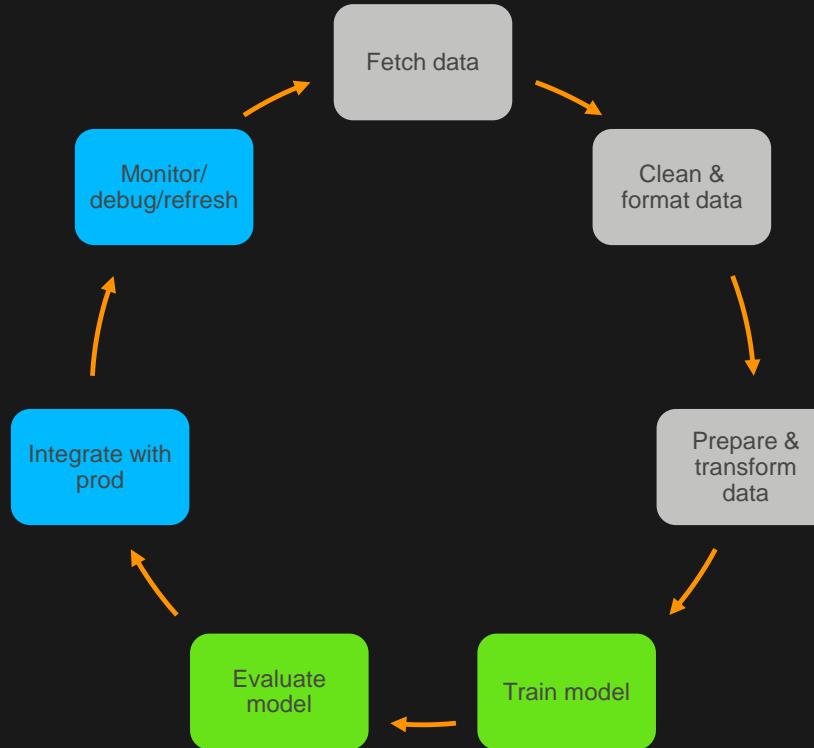
SOLUTIONS
DigitalGlobe |
Radiant



Machine learning process is hard...

Deployment

- Setup and manage inference clusters
- Manage and auto scale inference APIs
- Testing, versioning, and monitoring



Data wrangling

- Setup and manage notebook environments
- Get data to notebooks securely

Experimentation

- Setup and manage clusters
- Scale/distribute ML algorithms



...and time consuming



Solution: Amazon SageMaker

A managed service

that provides **the quickest and easiest way** for
your data scientists and developers to get
ML models from idea to production.



Amazon SageMaker

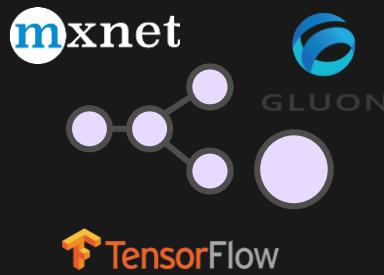
Build, train, and deploy machine learning models at scale



End-to-End
Machine Learning
Platform



Zero setup



Flexible Model
Training

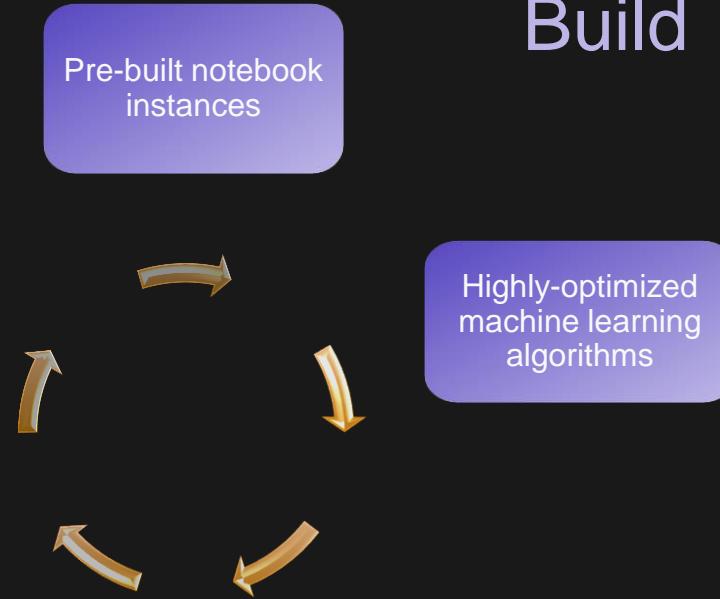


Pay by the
second



Amazon SageMaker

Build



Amazon SageMaker

Build

Pre-built notebook instances

Highly-optimized
machine learning
algorithms



Train

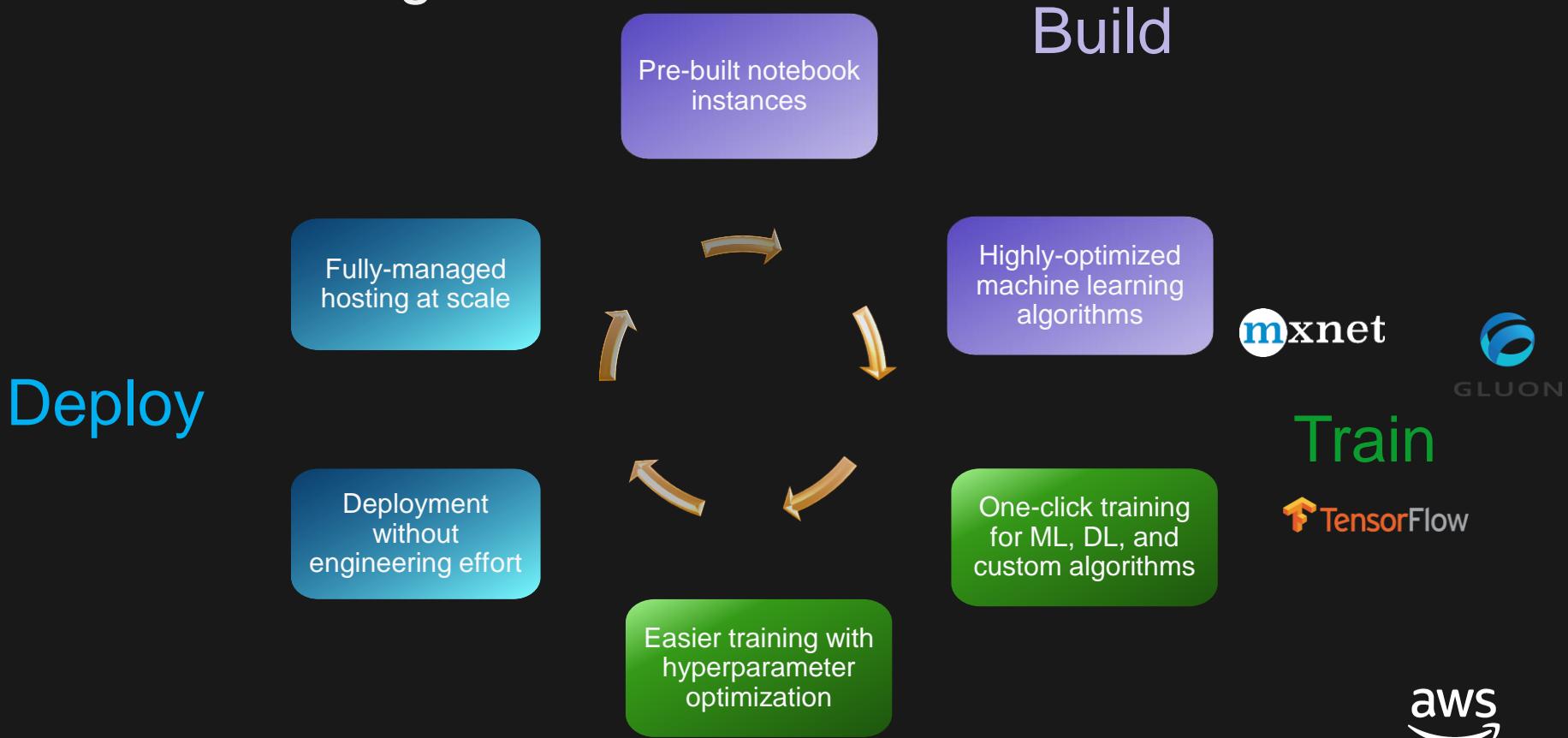
One-click training
for ML, DL, and
custom algorithms



Easier training with
hyperparameter
optimization



Amazon SageMaker



Algorithms designed for huge datasets



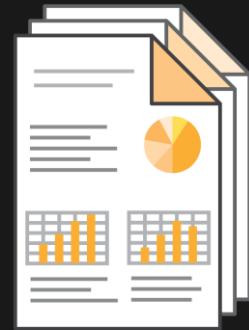
Streaming
datasets, for
cheaper training



Train faster, in a
single pass



Greater reliability
on extremely
large datasets



Choice of several
ML algorithms

Out[15]:

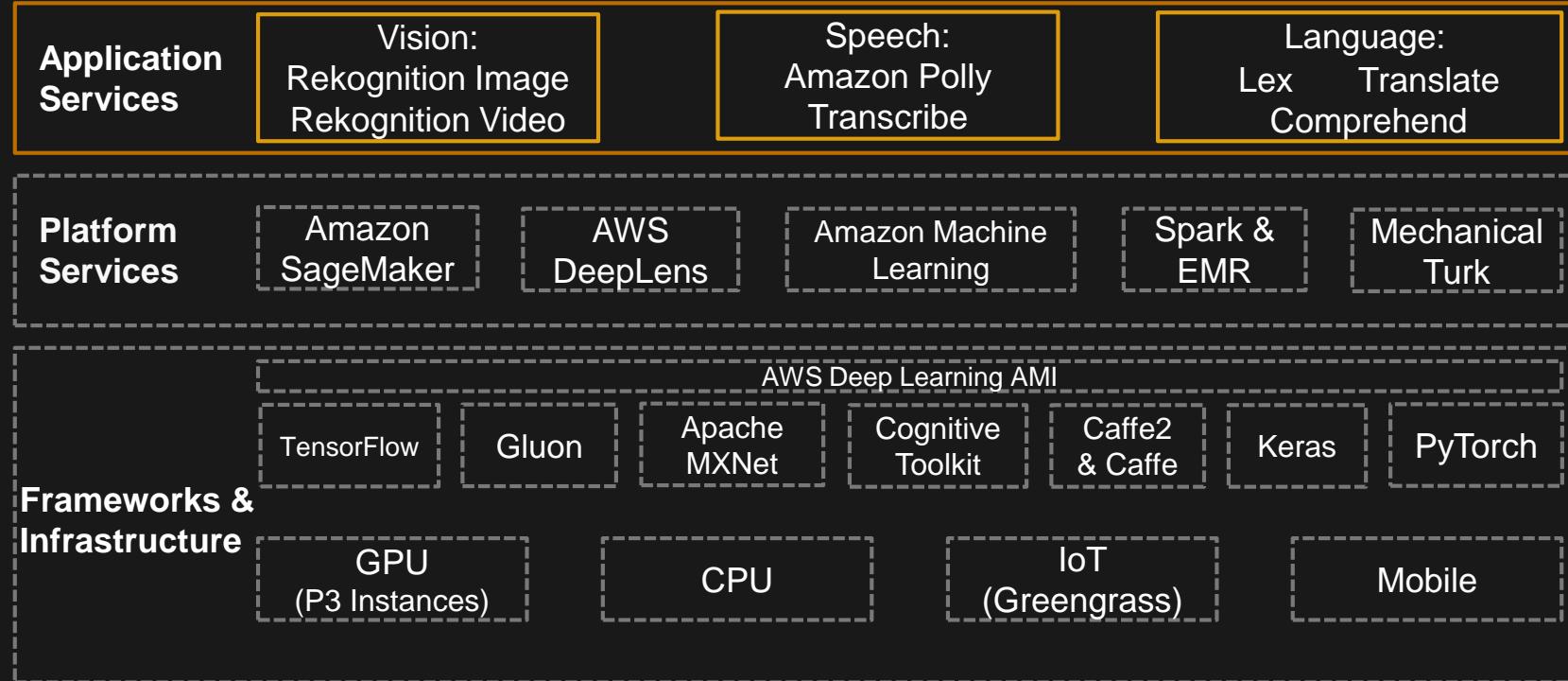
```
print("Result: label - " + object_categories[index] + ", probability - " + str(probabilities[index]))
```

Result: label - clutter, probability - 0.07000641524791718

Clean up



AWS ML Stack



Vision

Amazon Rekognition Image: Deep learning-based image analysis service



Object and Scene
Detection



Facial
Analysis



Face
Comparison



Facial
Recognition



Celebrity
Recognition



Image
Moderation

Rekognition: Text in Image



Results:

| IT'S - 97% |
| MONDAY - 99% |
| but - 97% | keep - 96% |
| Smiling - 99% |

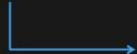


SmugMug



Rekognition: Real-Time Face Search

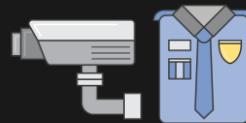
Real-time face recognition against tens of millions of faces



<0.5 second response time



Up to 10M faces



Enable Immediate response

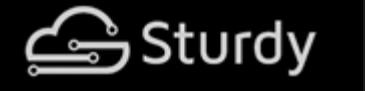
Amazon Rekognition Image Customers



THE TAKE



Openinfluence



Artfinder

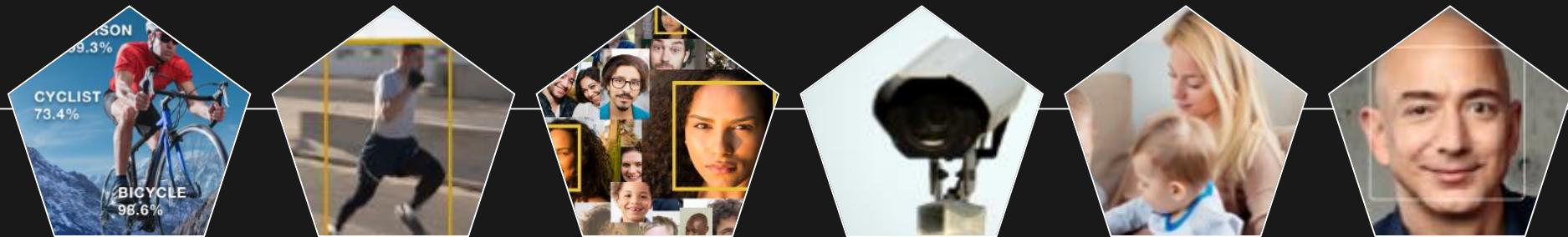
SOCIAL SOUP



How can we apply these powerful capabilities to video?

Amazon Rekognition Video

Video Analysis



Object and Activity
Detection

Person
Tracking

Face
Recognition

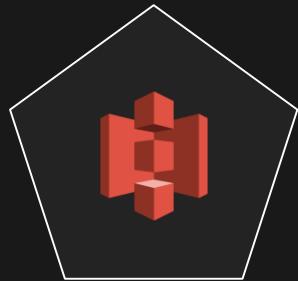
Real-time Live
Stream

Content Moderation

Celebrity
Recognition

Amazon Rekognition Video

One solution for all



Stored Video
Amazon S3

Media Search Index

Unsafe Video Detection
Investigative Analysis



Video Live Stream
Amazon Kinesis Video Stream

Public Safety Immediate Response

Home Monitoring



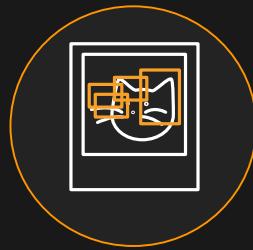
Amazon Rekognition Video

Primary Use Cases



Media and Entertainment

- Search & Filter



Public Safety

- Immediate Response
- Investigative Analysis



Smart Home

- Monitoring

Amazon Rekognition Video

Demo

Traffic Cam - Video
Analysis



Traffic Cam 352 - Riverview West
N Northbound

🕒 03:15:07:33

Mon, Nov 27, 2017

Speech

Amazon Polly

Use Cases

Content Creation

Mobile & Desktop Applications

Internet of Things (IoT)

Education & E-Learning

Telephony

Game Development

Key Features

50+ Voices across 27 languages

Lip-Syncing & Text Highlighting

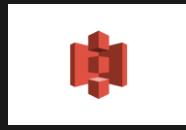
Fine-grained Voice Control

Custom Vocabularies

Amazon Polly Customers



Amazon Transcribe: Automatic Speech Recognition



Support for both
regular &
telephony audio

S3 Integration

Time Stamps



Punctuation
& formatting



Recognize
Multiple
Speakers



Custom
Vocabulary

Amazon Transcribe: Use Cases



Call
Centers



Subtitles for
VOD

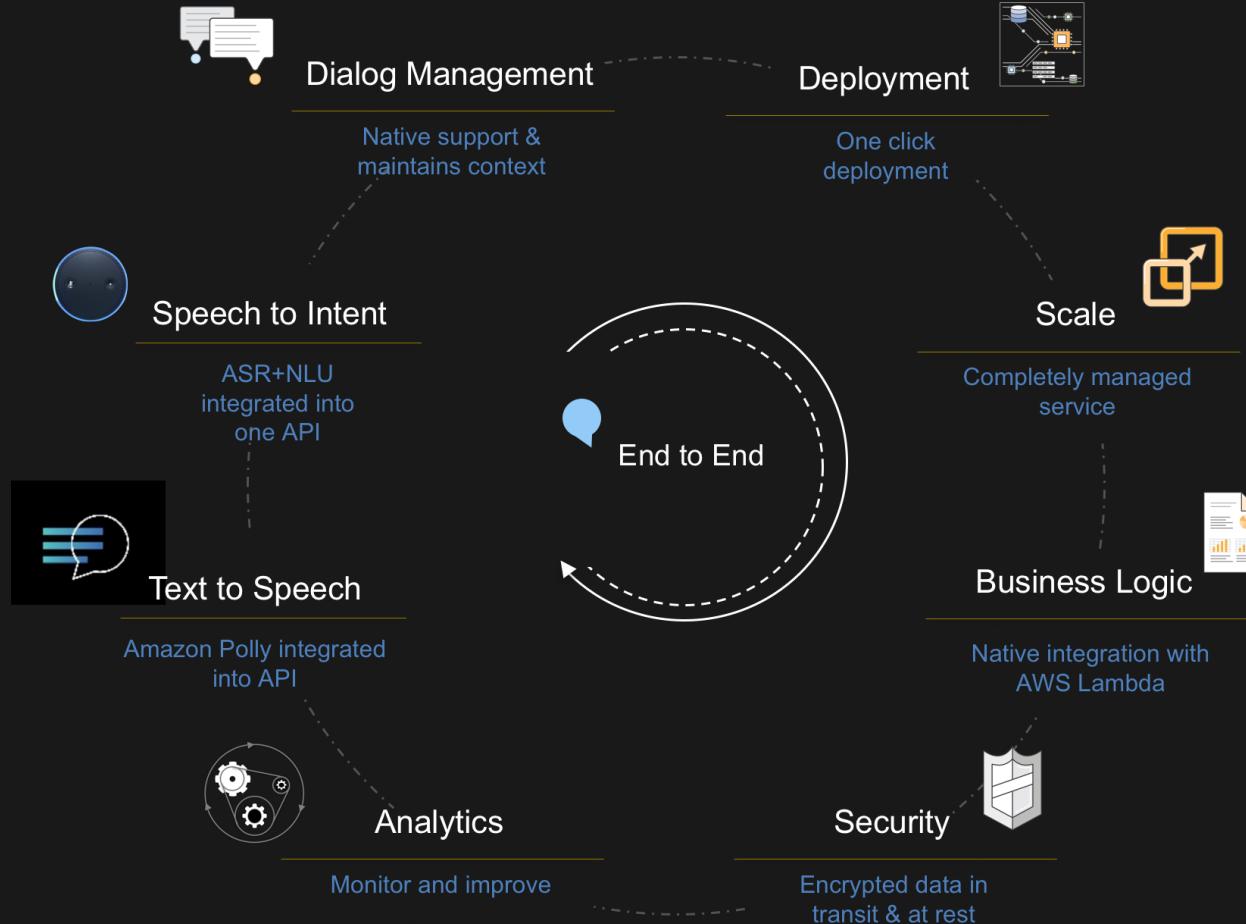


Broadcast closed
captions



Transcribe
meetings

Amazon Lex



Amazon Lex – Use Cases



Contact Center Bots

Chatbots for customer service IVR

- Account inquiries
- Bill payment
- Service update



Informational Bots

Chatbots for everyday consumer requests

- News updates
- Weather information
- Game scores



Application Bots

Build powerful interfaces to mobile applications

- Book tickets
- Order food
- Manage bank accounts



Enterprise Productivity Bots

Streamline enterprise work activities and improve efficiencies

- Check sales numbers
- Marketing performance
- Inventory status



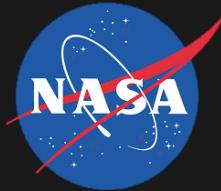
Internet of Things (IoT) Bots

Enable conversational interfaces for device interactions

- Wearables
- Appliances
- Auto



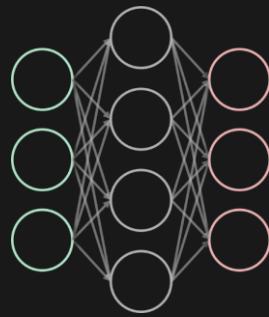
Amazon Lex Customers



Amazon Translate: Neural Machine Translation



REAL-TIME
TRANSLATION



POWERED BY DEEP
LEARNING



12 LANGUAGE PAIRS
(more to come)



LANGUAGE DETECTION

Translate - Quick Demo: a news article

Amazon Comprehend: Natural Language Processing



Sentiment



Entities



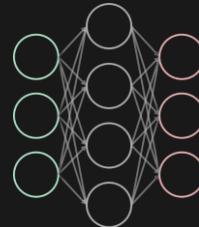
Key phrases



Languages



Topic modeling



Powered By Deep Learning



Amazon Comprehend: Extract Insight from Text

Amazon.com, Inc. is located in Seattle, WA and was founded July 5th, 1994 by Jeff Bezos. Our customers love buying everything from books to blenders at great prices

Named Entities

- Amazon.com : Organization
- Seattle, WA : Location
- July 5th, 1994 : Date
- Jeff Bezos : Person

Keyphrases

- Our customers
- books
- blenders
- great prices

Sentiment

- Positive

Language

- English



Amazon Comprehend: Use Cases



Voice of Customer Analytics

Analyzing what customer are saying about your brand, products, and services



Semantic Search

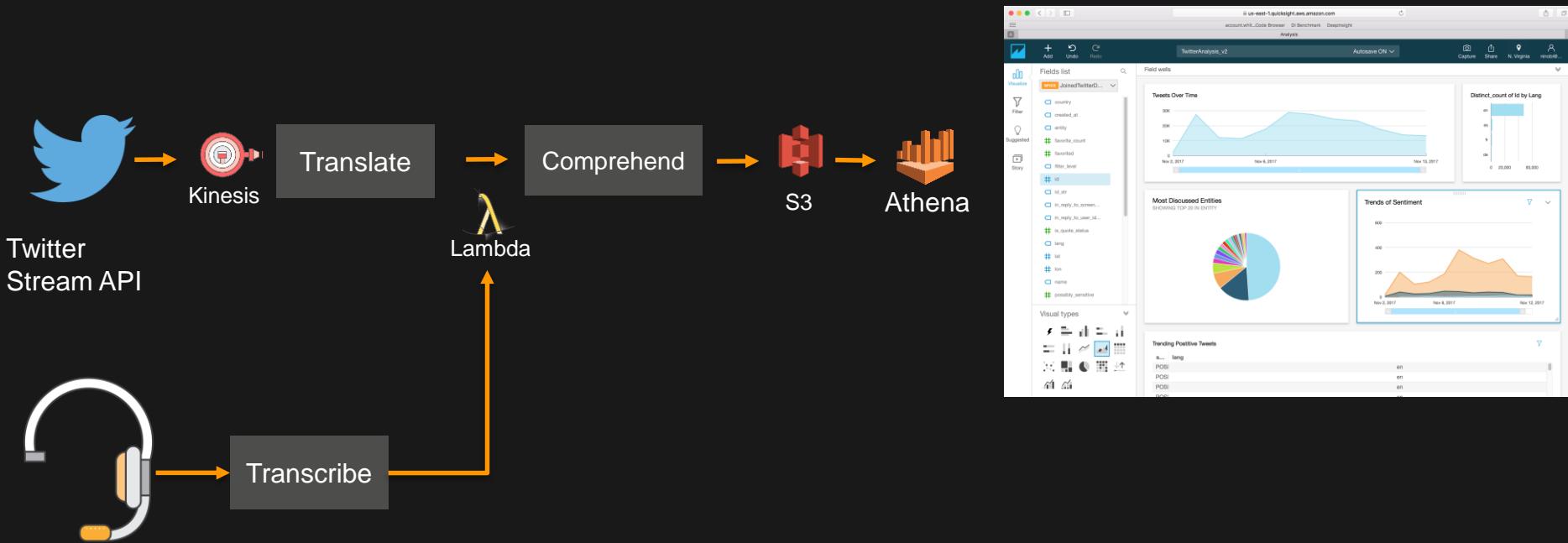
Making search smarter by searching on keyphrase, sentiment, and topic



Knowledge Management/Discovery

Organizing documents, categorizing by topic and personalizing experiences

Multilingual Social Analytics



Visualize

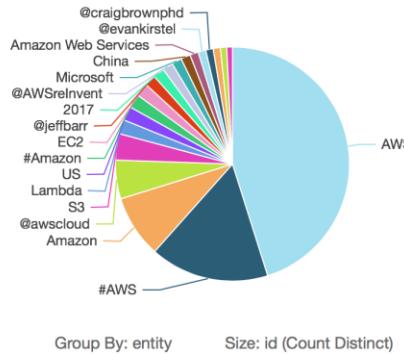
Filter

Suggested

Story

Field wells

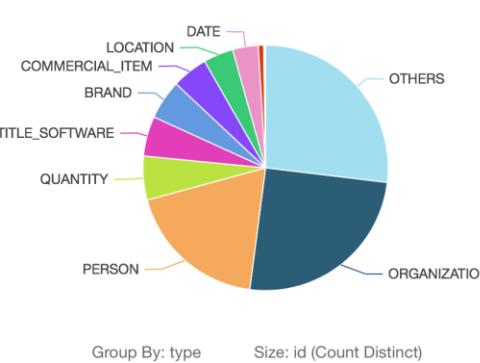
Most Discussed Entities SHOWING TOP 20 IN ENTITY



Entity

- 2017
- AWS
- #AWS
- Amazon
- @awscloud
- S3
- Lambda
- US
- #Amazon
- EC2
- @jeffbarr

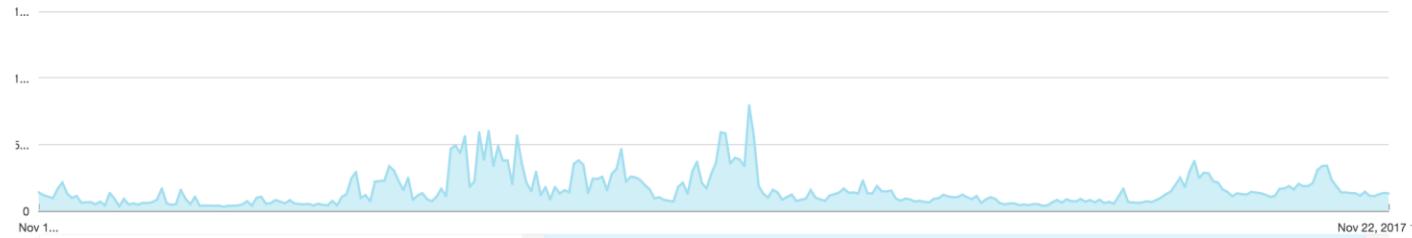
Most Discussed Entity Types

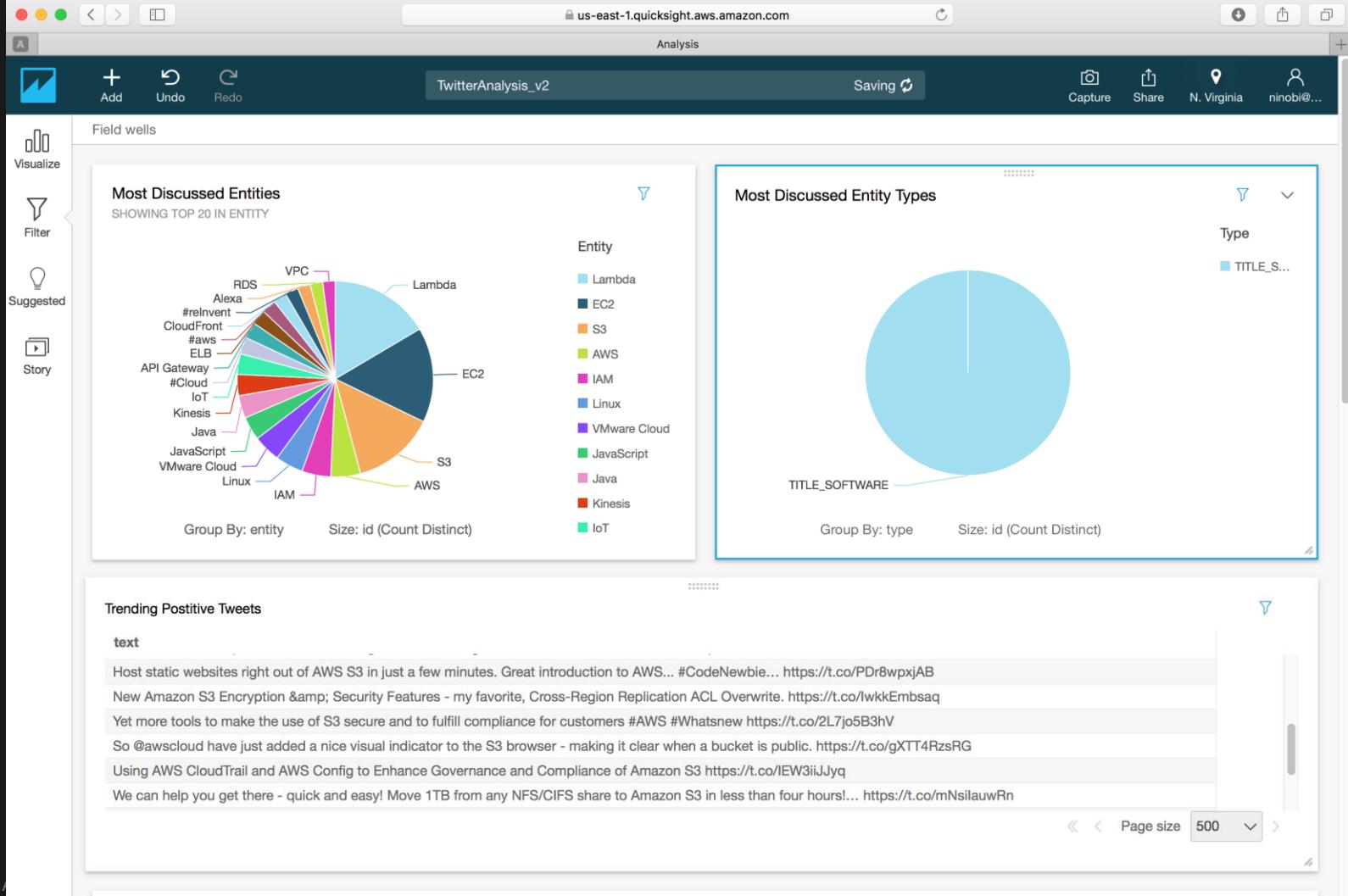


Type

- OTHERS
- ORGANIZATION
- PERSON
- QUANTITY
- TITLE_SOFTWARE
- BRAND
- LOCATION
- DATE
- EVENT
- TITLE_SOFTWARE
- OTHERS

Tweets Over Time





Multi-lingual Social Analytics: Poll

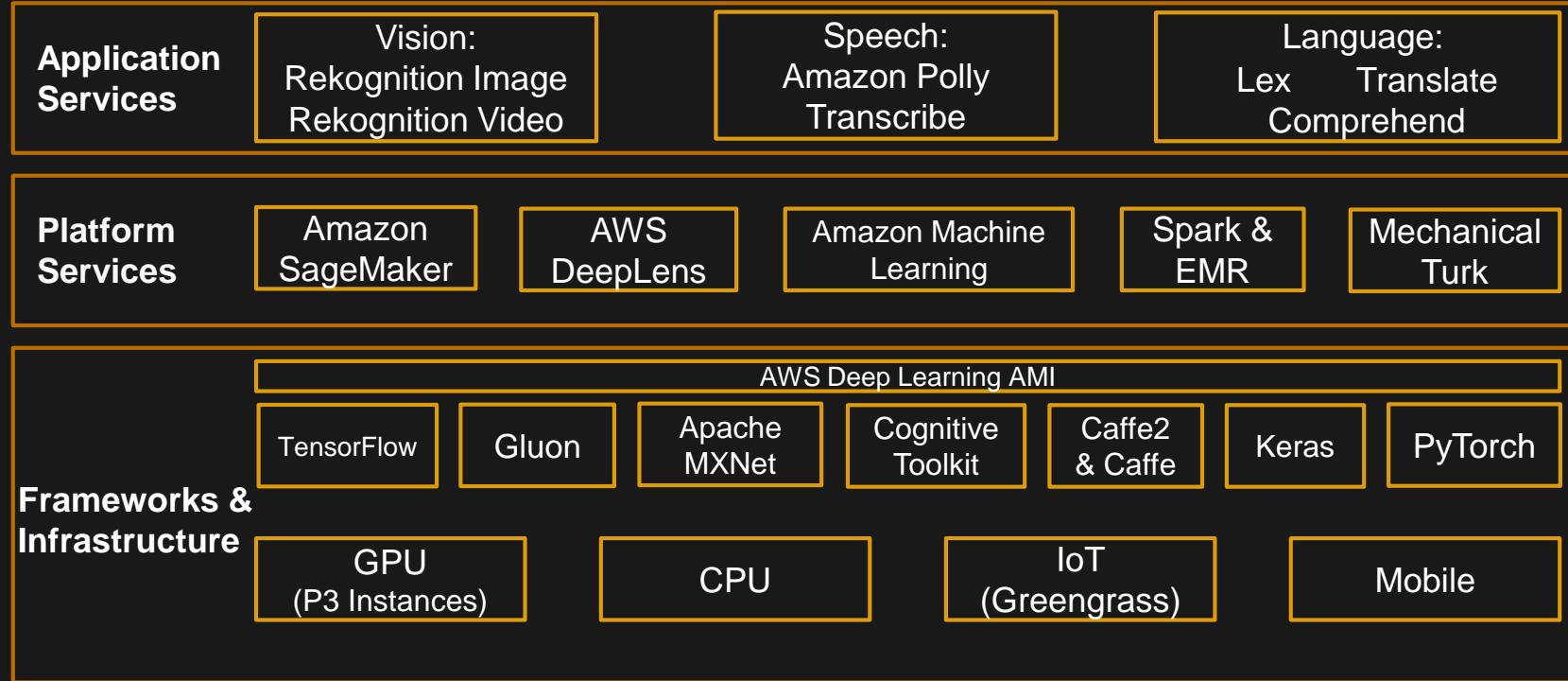
How long did this take to build?

1 day

How much does it cost to run per day?

\$17/day
(to analyze tweets for AWS-size
customer)

AWS ML Stack



Starting point for AI/ML on AWS:

<https://aws.amazon.com/machine-learning/>

Q & A

Thank you!