

# Innovating with AI and Machine Learning

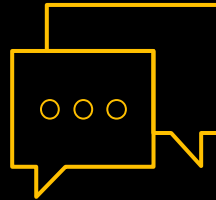
# AI is the centerpiece for digital transformation



Customer  
experience



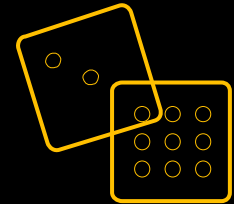
Business  
operations



Decision  
making



Innovation



Competitive  
advantage

**40%** of digital transformation initiatives  
supported by AI in 2019



## Welcome to Amazon.com Books!

*One million titles,  
consistently low prices.*

(If you explore just one thing, make it our personal notification service. We think it's very cool!)

### SPOTLIGHT! -- AUGUST 16TH

These are the books we love, offered at Amazon.com low prices. The spotlight moves **EVERY** day so please come often.

### ONE MILLION TITLES

Search Amazon.com's [million title catalog](#) by author, subject, title, keyword, and more... Or take a look at the [books we recommend](#) in over 20 categories... Check out our [customer reviews](#) and the [award winners](#) from the Hugo and Nebula to the Pulitzer and Nobel... and [bestsellers](#) are 30% off the publishers list...

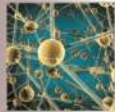
### EYES & EDITORS, A PERSONAL NOTIFICATION SERVICE

Like to know when that book you want comes out in paperback or when your favorite author releases a new title? Eyes, our tireless, automated search agent, will send you mail. Meanwhile, our human editors are busy previewing galleys and reading advance reviews. They can let you know when especially wonderful works are published in particular genres or subject areas. Come in, [meet Eyes](#), and have it all explained.

### YOUR ACCOUNT

Check the status of your orders or change the email address and password you have on file with us. Please note that you **do not** need an account to use the store. The first time you place an order, you will be given the opportunity to create an account.

Amazon.com, 1995



## Two Decades of Recommender Systems at Amazon.com

Amazon is well-known for personalization and recommendations, which help customers discover items they might otherwise not have found. In this update to our original article, we discuss some of the changes as Amazon has grown.

Brent Smith  
Amazon.com

Greg Linden  
Microsoft

For two decades now,<sup>1</sup> Amazon.com has been building a store for every customer. Each person who comes to Amazon.com sees it differently, because it's individually personalized based on their interests. It's as if you walked into a store and the shelves started rearranging themselves, with what you might want moving to the front, and what you're unlikely to be interested in shuffling further away.

From a catalog of hundreds of millions of items, Amazon.com's recommendations pick a small number of items you might enjoy based on your current context and your past behavior. The algorithms aren't magic; they simply share with you what other people have already discovered. The algorithm does all the work. It's computers helping people help other people, implicitly and anonymously. Amazon.com launched item-based collaborative filtering in 1998, enabling recommendations at a previously unseen scale for millions of customers and a catalog of millions of items. Since we wrote about the algorithm in *IEEE Internet Computing* in 2003,<sup>2</sup> it has seen widespread use across the Web, including YouTube, Netflix, and many others. The algorithm's success has been from its simplicity, scalability, and often surprising and useful

recommendations, as well as desirable properties such as updating immediately based on new information about a customer and being able to explain why it recommended something in a way that's easily understandable.

What was described in our 2003 *IEEE Internet Computing* article has faced many challenges and seen much development over the years. Here, we describe some of the updates, improvements, and adaptations for item-based collaborative filtering, and offer our view on what the future holds for collaborative filtering, recommender systems, and personalization.

### The Algorithm

As we described it in 2003, the item-based collaborative filtering algorithm is straightforward. In the mid-1990s, collaborative filtering was generally user-based, meaning the first step of the algorithm was to search across other users to find people with similar interests (such as similar purchase patterns), then look at what items those similar users found that you haven't found yet. Instead, our algorithm begins by finding related items for each item in the catalog. The term "related" could have several meanings here, but at this point,

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)  
★★★★★ 1,043 customer reviews

See all 4 formats and editions

<b>Hardcover</b> \$16.43 63 Used from \$9.92 50 New from \$10.00	<b>Paperback</b> from \$13.23 15 Used from \$13.43 4 New from \$13.23	<b>Audible</b> \$0.00 Free with your Audible trial
---	--	--

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 rapidly discover what works and what doesn't.

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

✓ This item: *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful...* by Eric Ries Hardcover \$16.43  
✓ *Zero to One: Notes on Startups, or How to Build the Future* by Peter Thiel Hardcover \$16.33

**customers Who Bought This Item Also Bought**

**ZERO ONE** Notes on Startups, or How to Build the Future by Peter Thiel Hardcover \$16.33

**Business Model Generation** A Handbook for Visionaries, Game Changers, and Challengers by Alexander Osterwalder and Yves Pigneur Paperback \$14.99

**The Startup Owner's Manual** The Step-By-Step Guide to Building a Successful Business by Steve Blank and Bob Dorf Hardcover \$24.95

**HOW TO WIN FRIENDS & INFLUENCE PEOPLE** by Dale Carnegie Paperback \$9.99

**THE \$100 STARTUP** How to Grow a Business from the Ground Up by Reid Hoffman Hardcover \$16.99

**The Innovator's Dilemma** The Revolutionary Book That Will Destroy the Big Companies by Clayton M. Christensen Hardcover \$16.99

**Value Proposition Design** How to Create, Test, and Validate New Value Propositions by Alexander Osterwalder and Yves Pigneur Paperback \$14.99

**THE HARD THING ABOUT HARD THINGS** by Seth Godin Hardcover \$16.99

**TRACTION** How Any Startup Can Achieve Explosive Customer Growth by Gabriel Orlin Hardcover \$16.99

**The 4-Hour Workweek** by Tim Ferriss Hardcover \$16.99

Page 1 of 10

most significant story of our time.  
The Four Anthony Goulet  
★★★★★ 13  
\$4.99

Ad feedback



# amazon echo





amazonrobotics





amazon

WALK OUT  
JUST  
WALK  
OUT  
SHOPPING





# Machine Learning at Amazon.com

## **RETAIL**

Demand Forecasting  
Vendor Lead Time Prediction  
Pricing  
Packaging  
Substitute Prediction

## **CATALOGUE**

Browse-Node Classification  
Meta-data Validation  
Review Analysis  
Product Matching

## **CUSTOMERS**

Recommendation  
Product Search  
Product Ads  
Shopping Advice  
Customer Problem  
Detection

## **TEXT**

In-Book Search  
Named-entity Extraction  
Summarization/X-ray  
Plagiarism Detection

## **SELLERS**

Fraud Detection  
Predictive Help  
Seller Search & Crawling

## **IMAGES**

Visual Search  
Product Image  
Enhancement  
Brand Tracking

# Our mission at AWS

Put machine learning in the hands  
of every developer

# Our Approach for Machine Learning



## Customer-focused

90%+ of our ML roadmap is defined by customers



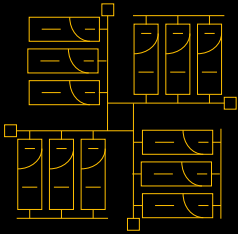
## Pace of innovation

200+ new ML launches and major feature updates in the last year



## Breadth and depth

A wide range of AI and ML services in-production



## Multi-framework

Support for the most popular frameworks



## Security and analytics

Deep set of security and encryption features, with robust analytics capabilities



## Embedded R&D

Customer-centric approach to advancing the state of the art



# More machine learning happens on AWS than anywhere else

10,000+ customers | 2x the customer references




# The AWS ML Stack

Broadest and deepest set of capabilities















## AI Services

VISION			SPEECH		LANGUAGE		CHATBOTS	FORECASTING	RECOMMENDATIONS
									
AMAZON REKOGNITION IMAGE	AMAZON REKOGNITION VIDEO	AMAZON TECTRACT	AMAZON POLLY	AMAZON TRANSCRIBE	AMAZON TRANSLATE	AMAZON COMPREHEND & AMAZON COMPREHEND MEDICAL	AMAZON LEX	AMAZON FORECAST	AMAZON PERSONALIZE

## ML Services

 <b>Amazon SageMaker</b>							
	Ground Truth	Notebooks	Algorithms + Marketplace	Reinforcement Learning	Training	Optimization	Deployment

## ML Frameworks +

Infrastructure FRAMEWORKS		INTERFACES	INFRASTRUCTURE									
<div> TensorFlow</div> <div> mxnet</div> <div> PYTORCH</div>		<div> GLUON</div> <div> Keras</div>	<div> EC2 P3 &amp; P3DN</div> <div> EC2 G4 EC2 C5</div> <div> FPGAs</div> <div> AWS DL CONTAINERS &amp; AMIs</div> <div> AMAZON ELASTIC CONTAINER SERVICE</div> <div> AMAZON ELASTIC KUBERNETES SERVICE</div> <div> AWS IoT GREENGRASS</div> <div> AMAZON ELASTIC INFERENCE</div> <div> AWS INFERENCE</div>									

Where can we find reference  
implementations applying ML to  
business problems?

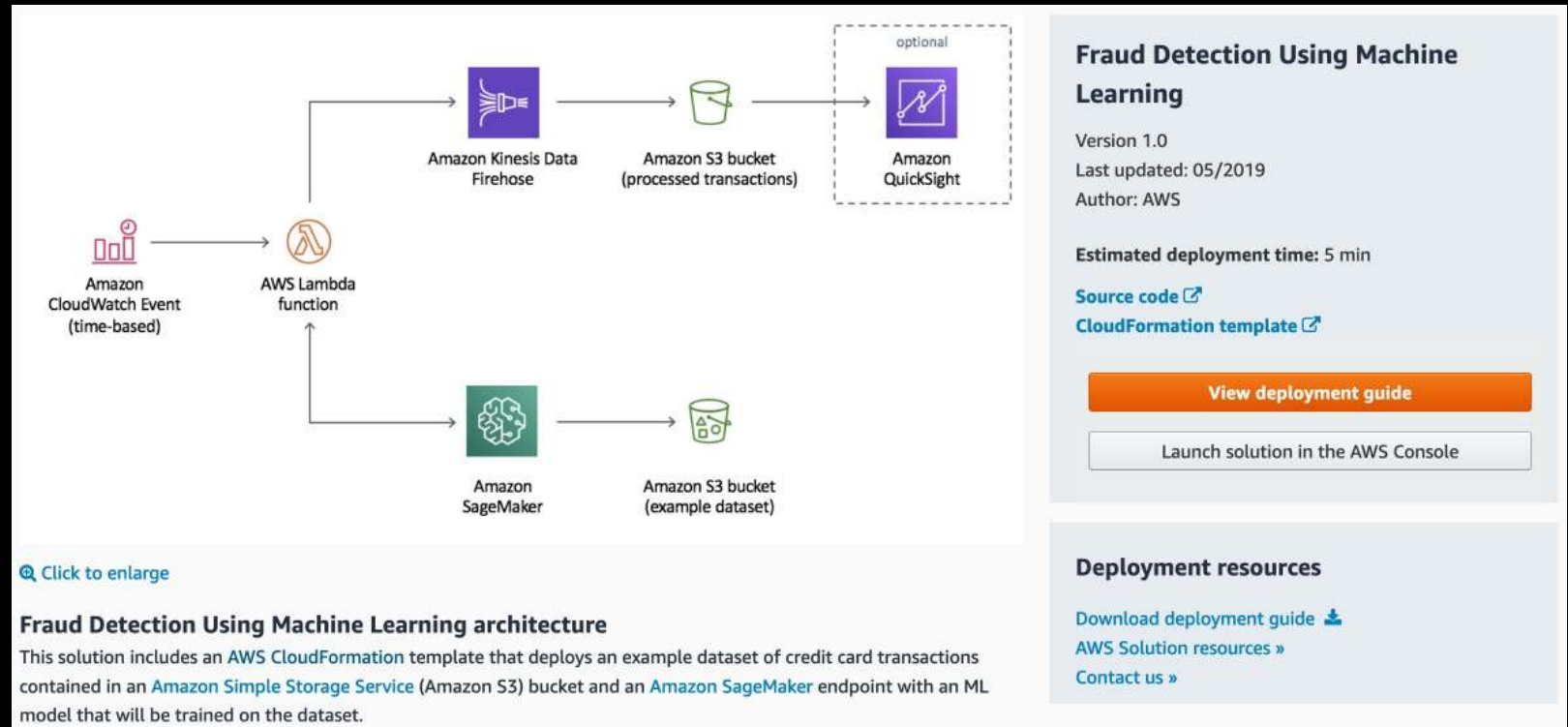


# AWS solutions for machine learning

<https://aws.amazon.com/solutions/>

Vetted, technical **reference implementations** designed to help you solve common problems and build faster

- Detailed architecture
- Deployment guide
- Instructions for both automated and manual deployment



Where can we find off-the-shelf  
algorithms and models?

# AWS Marketplace for Machine Learning

<https://aws.amazon.com/marketplace/solutions/machinelearning/>

- Algorithms and model packages
- Deploy directly on Amazon SageMaker through a Jupyter Notebook, Amazon SageMaker SDK, or AWS CLI
- Free, free trial, or paid
- Pay as you go

The screenshot displays the AWS Marketplace interface for Machine Learning solutions. On the left, a sidebar contains a 'Categories' section with links to 'All Categories', 'Infrastructure Software (33)', 'DevOps (33)', 'Business Applications (2)', 'Machine Learning (248)', 'IoT (10)', and 'Industries (48)'. Below this is a 'Filters' section with a 'Clear all filters' link, followed by a 'Vendors' section listing various providers like Perception Health, RocketML, Sensifai, Cloudwick, Figure Eight, and Persistent Systems. The main content area shows search results for 'All Categories (248 results)' with a pagination bar at the top right. Two results are visible: 'Text Similarity Analyzer' by TIBCO Data Science and 'GluonNLP Sentence Generator' by Amazon Web Services. Each result includes a star rating, version number, seller information, a brief description, and a fulfillment status (e.g., 'Algorithm - Fulfilled on Amazon SageMaker').

**Categories**

All Categories

- Infrastructure Software (33)
- DevOps (33)
- Business Applications (2)
- Machine Learning (248)
- IoT (10)
- Industries (48)

**Filters** [Clear all filters](#)

**Vendors**

- ☐ Perception Health (31)
- ☐ RocketML (23)
- ☐ Sensifai (18)
- ☐ Cloudwick (11)
- ☐ Figure Eight (11)
- ☐ Persistent Systems (10)

**All Categories (248 results)** showing 1 - 10

**TIBCO**  
Data Science

**Text Similarity Analyzer**

★★★★★ (0) | Version v1 | Sold by [TIBCO Software Inc.](#)

This algorithm produces similarity scores for a document or a line of text compared to documents in a corpus. The algorithm includes a tf-idf text featurizer to create n-gram features describing the text. It then uses the library scipy.spatial.distance to compute the cosine distance between the new...

Algorithm - Fulfilled on Amazon SageMaker

**aws**

**GluonNLP Sentence Generator**

★★★★★ (1) | Version 1.0 | Sold by [Amazon Web Services](#)

Given an incomplete sentence, this model predicts sentences that are most likely to occur in the context. For example, given input "I love it", it will generate samples like "I love it and enjoy one of their series, Schafer or Clive ."

Model Package - Fulfilled on Amazon SageMaker



Can we just call APIs  
and get the job done?


# The AWS ML Stack

Broadest and deepest set of capabilities













## AI Services

VISION			SPEECH		LANGUAGE		CHATBOTS	FORECASTING	RECOMMENDATIONS
									
AMAZON REKOGNITION IMAGE	AMAZON REKOGNITION VIDEO	AMAZON TEXTTRACT	AMAZON POLLY	AMAZON TRANSCRIBE	AMAZON TRANSLATE	AMAZON COMPREHEND & AMAZON COMPREHEND MEDICAL	AMAZON LEX	AMAZON FORECAST	AMAZON PERSONALIZE

## ML Services

 <b>Amazon SageMaker</b>	Ground Truth	Notebooks	Algorithms + Marketplace	Reinforcement Learning	Training	Optimization	Deployment	Hosting
---	--------------	-----------	--------------------------	------------------------	----------	--------------	------------	---------

## ML Frameworks +

InfraSTRUCTURE	FRAMEWORKS	INTERFACES	INFRASTRUCTURE									
	 TensorFlow  mxnet  PYTORCH	 GLUON  K Keras	 EC2 P3 & P3DN	 EC2 G4 EC2 C5	 FPGAs	 AWS DL CONTAINERS & AMIs	 AMAZON ELASTIC CONTAINER SERVICE	 AMAZON ELASTIC KUBERNETES SERVICE	 AWS IoT GREENGRASS	 AMAZON ELASTIC INFERENCE	 AWS INFERENTIA	

Every organization has tons  
of documents to process.

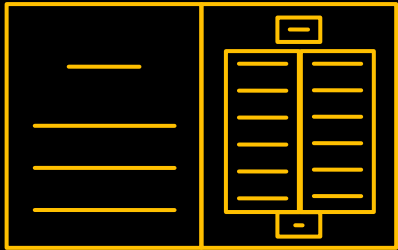
Can we make OCR smarter?



# Amazon Textract

Extract text and data from virtually any document

<https://aws.amazon.com/blogs/machine-learning/automatically-extract-text-and-structured-data-from-documents-with-amazon-textract/>



Extract data quickly  
and accurately



Eliminate  
manual effort



Lower document  
processing costs

---

## KEY FEATURES

Optical character  
recognition (OCR)

Key-value pair  
detection

Table  
detection

Adjustable  
confidence  
thresholds

Bounding box  
coordinates

No ML experience  
required

Voice is the interface of the future.

Can text-to-speech sound  
even more lifelike?

# Amazon Polly NTTS and newscaster style

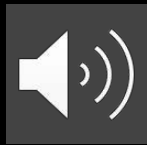
<https://aws.amazon.com/blogs/aws/amazon-polly-introduces-neural-text-to-speech-and-newscaster-style/>

## US English Matthew voice

“Sources tell CNN he believes the media and the northeast elite are needlessly hyperventilating and overreacting to his comments.”



Standard



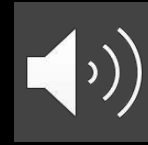
Neural NTTS



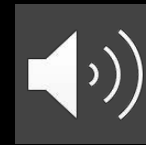
Newscaster  
NTTS

## US English Joanna voice

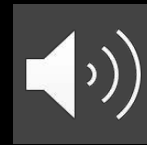
“President Donald Trump said on March 13 his administration was ordering the grounding of all Max 8 and 9 models, hours after Canada said it was grounding the planes after analyzing new satellite tracking data.”



Standard



Neural NTTS



Newscaster  
NTTS

# Scaling FICO Customer Communication Services



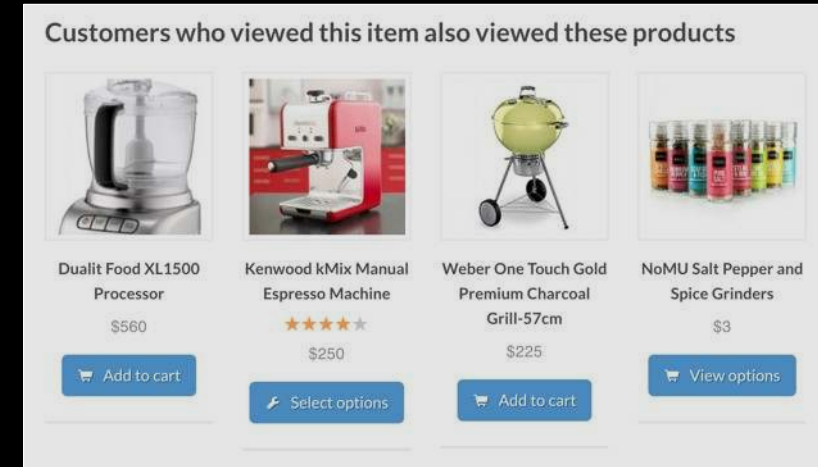
<https://www.youtube.com/watch?v=OhLrxGw-zJA>

Many organizations want to personalize  
the user experience

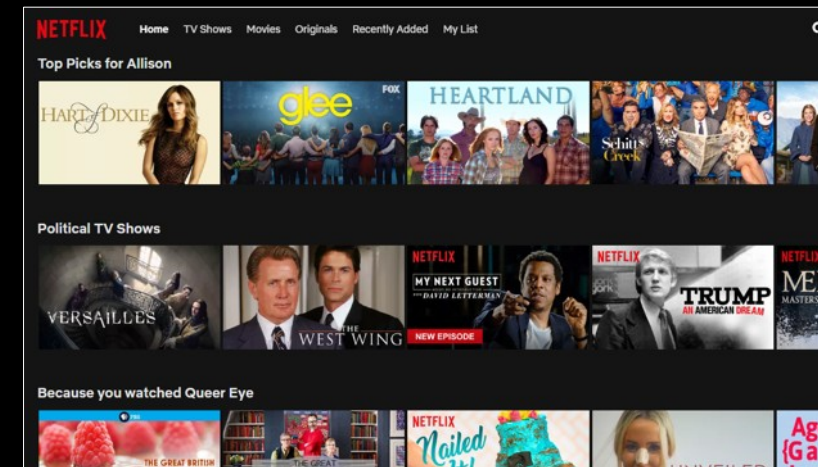


# Personalization offers material business results

30% of page views on Amazon



80% of views on Netflix

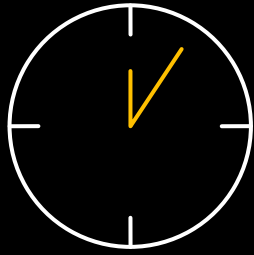


# Amazon Personalize

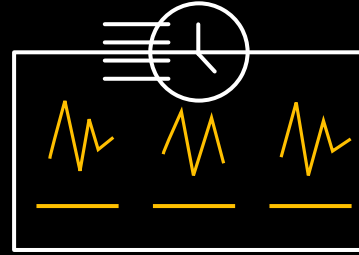
Improve customer experiences with personalization and recommendations



Deliver high quality recommendations



Real-time



Deliver personalization in days, not months



Works with any product or content

---

## KEY FEATURES

Simple data schemas

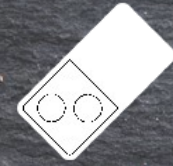
Pre-defined or custom recipes

Automated machine learning and tuning

Fully-managed infrastructure

Based on the technology used at Amazon.com





# Domino's

## Personalizing customer experiences

Domino's uses Amazon Personalize to customize and scale relevant marketing communications to customers based on time, context, and content, thereby improving and enhancing their experience with the Domino's brand.



# Getting started


# The AWS ML Stack

<https://ml.aws>















## AI Services

VISION			SPEECH		LANGUAGE		CHATBOTS	FORECASTING	RECOMMENDATIONS
									
AMAZON REKOGNITION IMAGE	AMAZON REKOGNITION VIDEO	AMAZON TECTRACT	AMAZON POLLY	AMAZON TRANSCRIBE	AMAZON TRANSLATE	AMAZON COMPREHEND & AMAZON COMPREHEND MEDICAL	AMAZON LEX	AMAZON FORECAST	AMAZON PERSONALIZE

## ML Services

 <b>Amazon SageMaker</b>							
	Ground Truth	Notebooks	Algorithms + Marketplace	Reinforcement Learning	Training	Optimization	Deployment

## ML Frameworks +

Infrastructure FRAMEWORKS		INTERFACES	INFRASTRUCTURE									
<div> TensorFlow</div> <div> mxnet</div> <div> PYTORCH</div>		<div> GLUON</div> <div> Keras</div>	<div> EC2 P3 &amp; P3DN</div> <div> EC2 G4 EC2 C5</div> <div> FPGAs</div> <div> AWS DL CONTAINERS &amp; AMIs</div> <div> AMAZON ELASTIC CONTAINER SERVICE</div> <div> AMAZON ELASTIC KUBERNETES SERVICE</div> <div> AWS IoT GREENGRASS</div> <div> AMAZON ELASTIC INFERENCE</div> <div> AWS INFERENTIA</div>									



# Thank you!