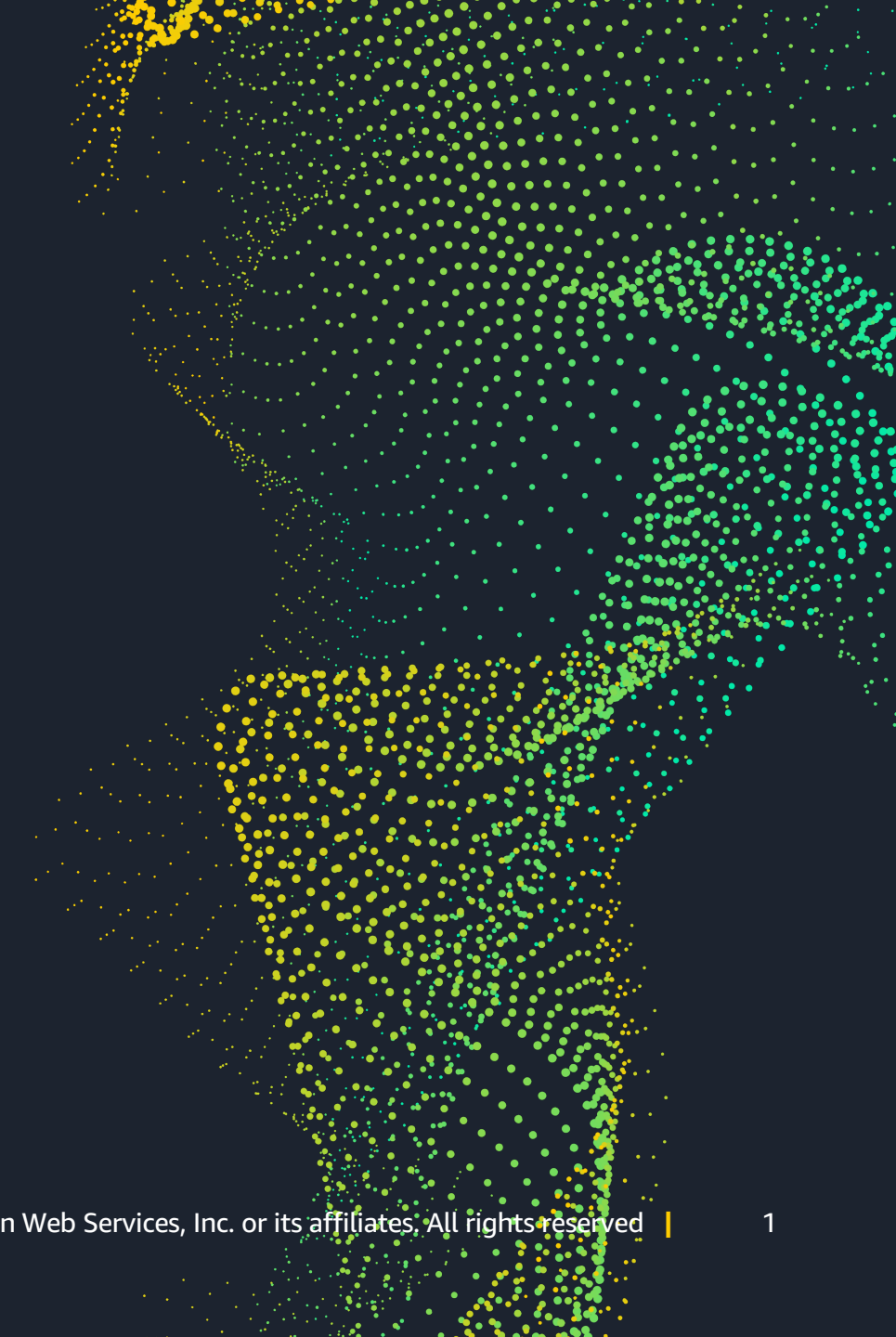
aws machine learning

Machine learning Immersion day

22 April, 2020

Shasha Tursunova, Account Manager, AWS
Yegor Tokmakov, Solutions Architect, AWS
Tim Berger, Solutions Architect, AWS



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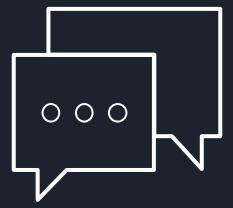
Today's Agenda

09.00 – 09.30	Welcome & Registration
09.30 – 10.00	Intro to AI / ML on AWS
10.00 – 11:00	Workshop: AWS AI services
11.00 – 12.00	Intro to Amazon SageMaker
12.00 – 13.00	*Lunch break*
13.00 – 14.00	Workshop: SageMaker Introduction
14.00 – 15.00	TensorFlow ♡ Amazon SageMaker
15.00 – 16.00	Workshop: TensorFlow on SageMaker
16.00 – 16.30	Wrap Up, Q&A and survey

Centerpiece for digital transformation

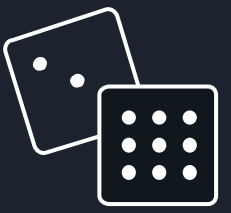
Customer experience

Business operations



Decision making

Innovation



Competitive advantage

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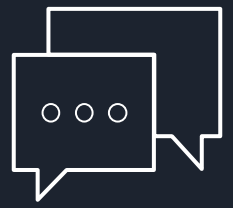
Centerpiece for digital transformation

Customer experience

Business operations



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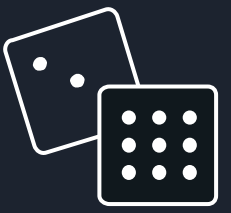

Competitive advantage

40% of organizations plan to deploy AI solution by the end of 2020 *- Gartner 2020 CIO Agenda*

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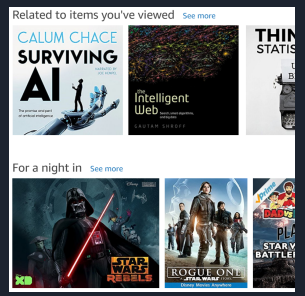
Our mission at AWS

Put machine learning in the hands
of every developer

Machine Learning at Amazon: A long heritage

Personalized Recommendations



Fulfillment automation & Inventory Management

Drones

Voice driven Interactions

Inventing entirely new Customer experiences

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More machine learning happens on AWS than anywhere else

https://aws.amazon.com/machine-learning/customers/

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Why AWS for AI?

Broadest and deepest set of AI and ML services

200 new features & services launched this last year alone

Unmatched flexibility

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Unmatched flexibility

Accelerate your adoption of ML with SageMaker

70% cost reduction in data-labeling

10x faster performance

75% lower inference cost

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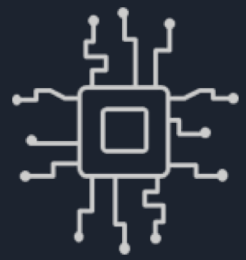

Built on the most comprehensive cloud platform optimized for ML

AWS holds the top spots on Stanford's benchmark, for fastest training time, lowest cost, lowest inference latency

The AWS ML Stack

AI SERVICES

VISION	SPEECH		TEXT			SEARCH	CHATBOTS	PERSONALIZATION	FORECASTING	FRAUD	DEVELOPMENT	CONTACT CENTERS
Amazon Rekognition	Amazon Polly	Amazon Transcribe *+Medical*	Amazon Comprehend *+Medical*	Amazon Translate	Amazon Textract	Amazon Kendra	Amazon Lex	Amazon Personalize	Amazon Forecast	Amazon Fraud Detector	Amazon CodeGuru	Contact Lens *For Amazon Connect*

ML SERVICES

Amazon SageMaker	Ground Truth	ML Marketplace	SageMaker Studio IDE							Neo	Augmented AI
			Built-in algorithms	Notebooks	Experiments	Model training & tuning	Debugger	Autopilot	Model hosting	Model Monitor	

ML FRAMEWORKS & INFRASTRUCTURE

TensorFlow · mxnet · PYTORCH · GLUON · Keras · DeepGraphLibrary · Deep Learning AMIs & Containers · GPUs & CPUs · Elastic Inference · Inferentia · FPGA

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The AWS ML Stack

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So, what's in it for me?

	Data Scientist	Data Engineer	Developer	Decision Maker
AI SERVICES	Rapid Prototype Feature testing Focus on more complex tasks No infrastructure No deployment	Quickly iterate on data format and features Focus on more complex tasks No infrastructure No deployment	Quick integration Self serve No Data Science background No infrastructure No deployment	Solve business problems and add rich features quickly No Data Science background No infrastructure No deployment
ML SERVICES	Optimized Frameworks Unified environment Jupyter notebooks Full control Modular architecture	Unified deployment Integrates with IAM, VPC Elastic scaling Labeling Performance optimized	Easy integration Example notebooks A/B testing models	Optimize for a domain specific problem Optimize for performance
ML FRAMEWORKS & INFRASTRUCTURE	Choose optimal hardware Target IoT devices Full control	Choose optimal hardware	Endpoint data structures	Solving business differentiating problems

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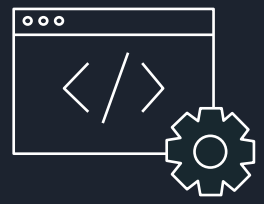
AI Services

Vision | Speech | Language | Chatbots | Forecasting | Recommendations

REKOGNITION IMAGE | REKOGNITION VIDEO | TEXTRACT | POLLY | TRANSCRIBE | TRANSLATE | COMPREHEND | LEX | FORECAST | PERSONALIZE

Pre-trained AI services that require no ML skills or training



Easily add intelligence to your existing apps and workflows

Quality and accuracy from continuously-learning APIs

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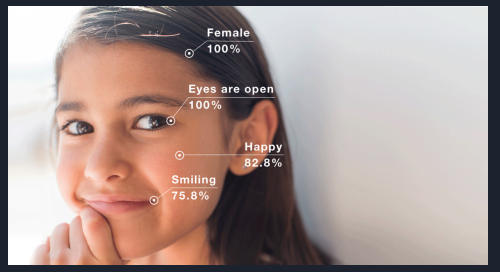
Amazon Rekognition

Deep learning-based image and video analysis

Object, Scene & Activity Recognition

Facial Recognition

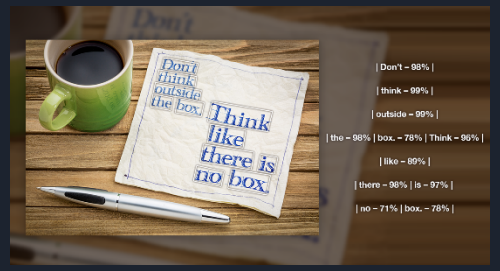


Facial Analysis

Person Tracking

Unsafe Content Detection

Celebrity Recognition



Text in Images

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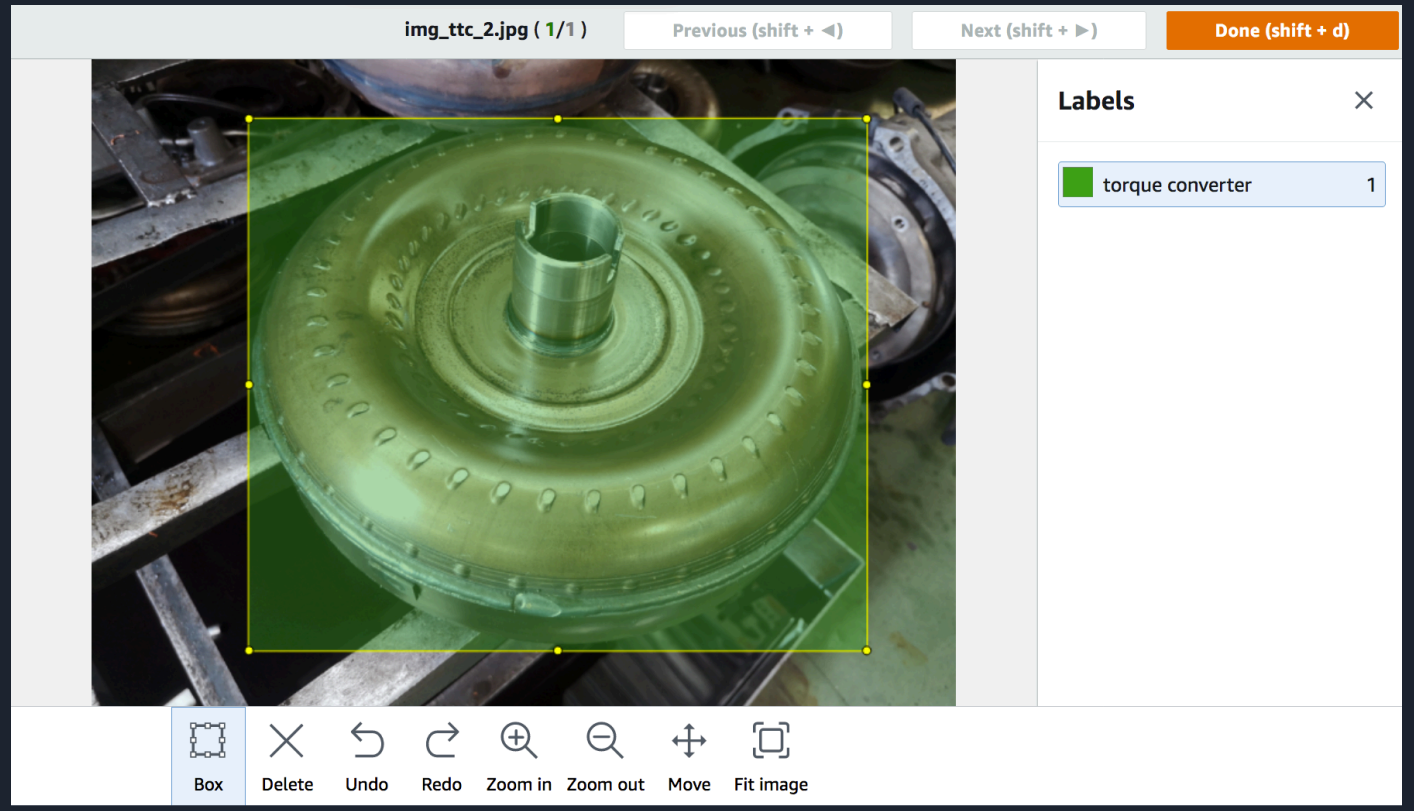
Amazon Rekognition

Custom Labels



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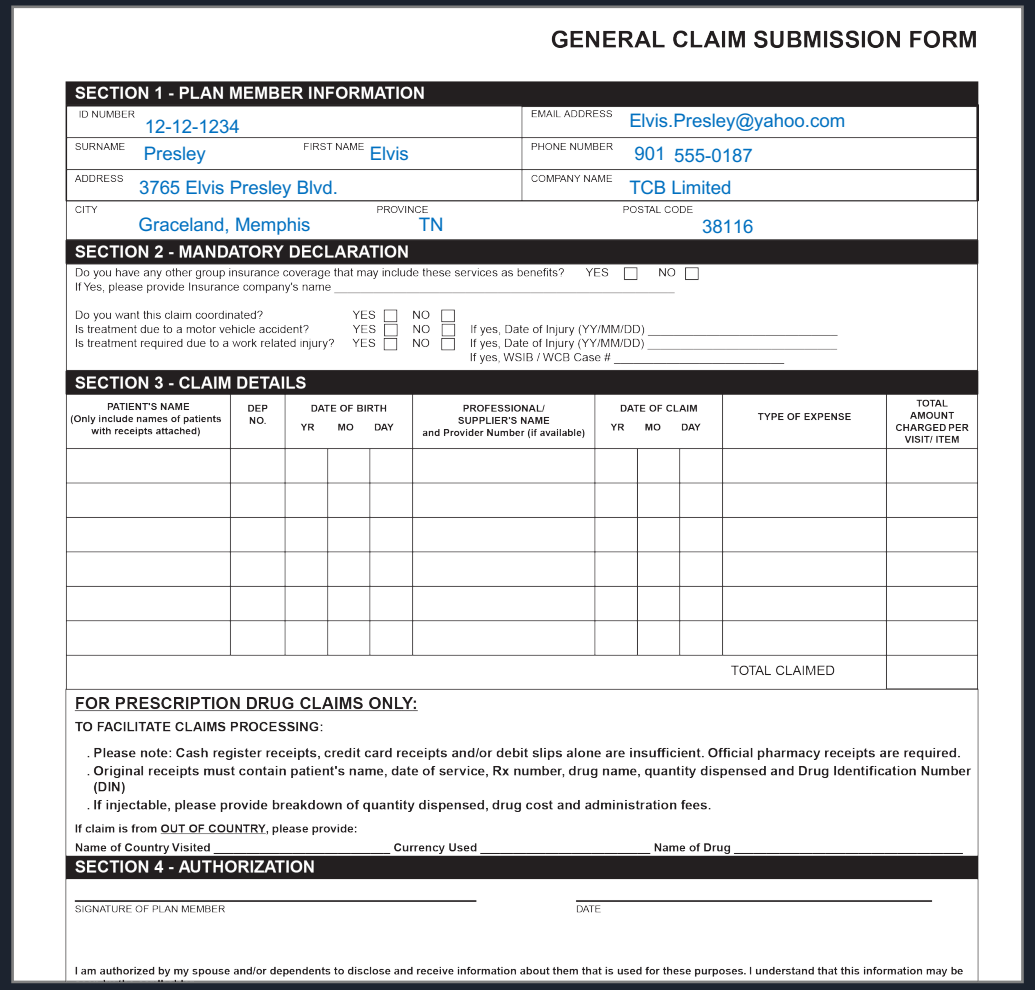
Amazon Textract

Automatic document processing without data entry, or writing rules



GENERAL CLAIM SUBMISSION FORM

SECTION 1 - PLAN MEMBER INFORMATION

ID NUMBER	12-12-1234	EMAIL ADDRESS	Elvis.Presley@yahoo.com
SURNAME	Presley	FIRST NAME Elvis	PHONE NUMBER 901 555-0187
ADDRESS	3765 Elvis Presley Blvd.		COMPANY NAME TCB Limited
CITY	Graceland, Memphis	PROVINCE TN	POSTAL CODE 38116

SECTION 2 - MANDATORY DECLARATION

Do you have any other group insurance coverage that may include these services as benefits? YES ☐ NO ☐
If Yes, please provide Insurance company's name _____

Do you want this claim coordinated? YES ☐ NO ☐
Is treatment due to a motor vehicle accident? YES ☐ NO ☐ If yes, Date of Injury (YY/MM/DD) _____
Is treatment required due to a work related injury? YES ☐ NO ☐ If yes, Date of Injury (YY/MM/DD) _____
If yes, WSIB / WCB Case # _____

SECTION 3 - CLAIM DETAILS

PATIENT'S NAME (Only include names of patients with receipts attached)	DEP NO.	DATE OF BIRTH YR	MO	DAY	PROFESSIONAL/ SUPPLIER'S NAME and Provider Number (if available)	DATE OF CLAIM YR	MO	DAY	TYPE OF EXPENSE	TOTAL AMOUNT CHARGED PER VISIT/ ITEM
									TOTAL CLAIMED	

FOR PRESCRIPTION DRUG CLAIMS ONLY:

TO FACILITATE CLAIMS PROCESSING:

. Please note: Cash register receipts, credit card receipts and/or debit slips alone are insufficient. Official pharmacy receipts are required.
. Original receipts must contain patient's name, date of service, Rx number, drug name, quantity dispensed and Drug Identification Number (DIN)
. If injectable, please provide breakdown of quantity dispensed, drug cost and administration fees.

If claim is from OUT OF COUNTRY, please provide:
Name of Country Visited _____ Currency Used _____ Name of Drug _____

SECTION 4 - AUTHORIZATION

_____ SIGNATURE OF PLAN MEMBER

_____ DATE

I am authorized by my spouse and/or dependents to disclose and receive information about them that is used for these purposes. I understand that this information may be

OCR++

Name	Presley, Elvis Aaron
Address	Graceland, Memphis, TN
Id	12-12-1234
Company	TCB Limited

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Amazon Polly

Turn text into lifelike speech using deep learning

Wide Selection of Voices and Languages

Synchronize Speech

Fine-grained Control

Unlimited Replay

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Amazon Transcribe

Automatic conversion of speech into accurate, grammatically correct text

Multiple languages

Intelligent punctuation and formatting

Timestamp generation

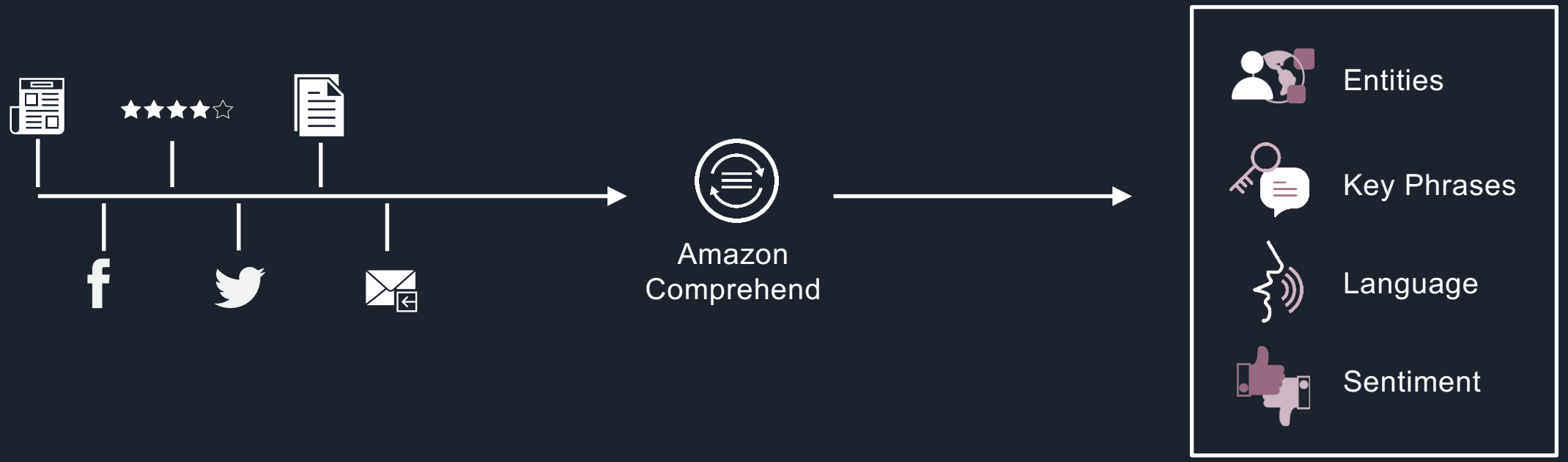
Support for telephony audio

Recognize multiple speakers

Custom vocabulary

Amazon Comprehend

Discover insights and relationships in text



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Amazon Comprehend

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

Key phrases

- Our customers
- books
- blenders
- great prices

Sentiment

- *Positive*

Language

- English

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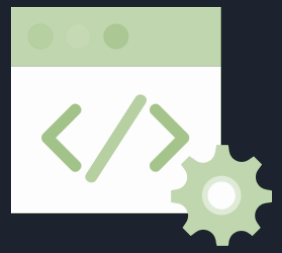
Amazon Lex

Conversational interfaces for your applications powered by the same deep learning technologies as Alexa

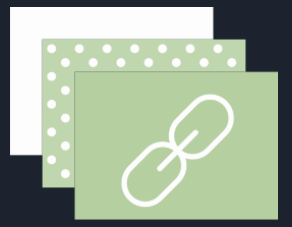


Integrated development in the AWS console

Trigger Lambda functions

Multi-step conversations

One-click deployment



Enterprise connectors

Fully managed

Amazon Forecast

Accurate time-series forecasting service, based on the same technology used at Amazon.com

Any historical time-series

Integrates with SAP and Oracle Supply Chain

Integrates with Amazon Timestream

Custom forecasts with 3 clicks

50% more accurate

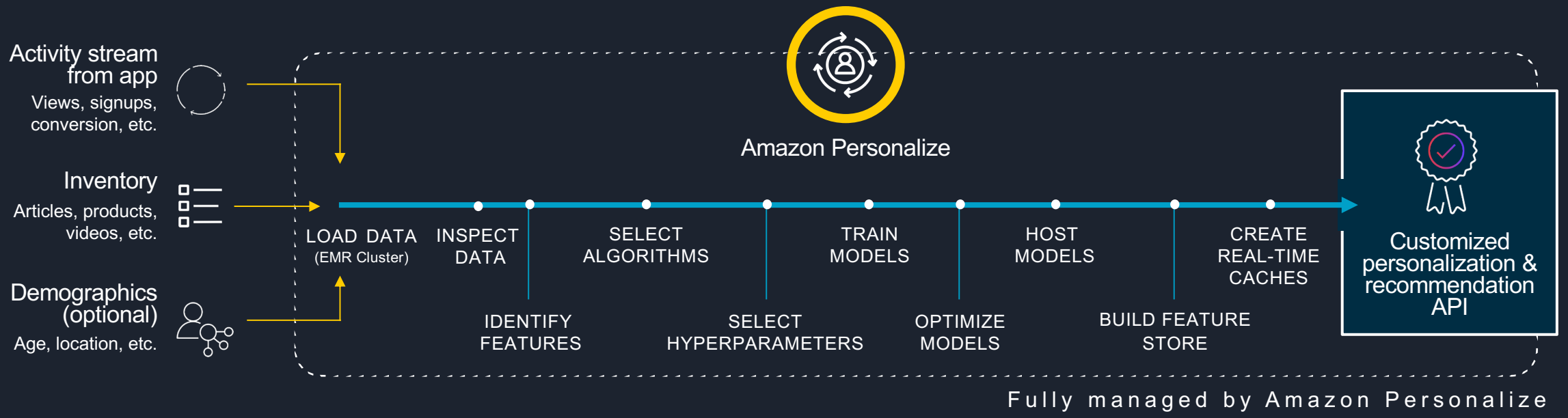
1/10th the cost

Generate forecasts for:

Retail demand	Travel demand	AWS usage
Revenue forecasts	Web traffic	Advertising demand

Amazon Personalize

Real-time personalization and recommendation service, based on the same technology used at Amazon.com



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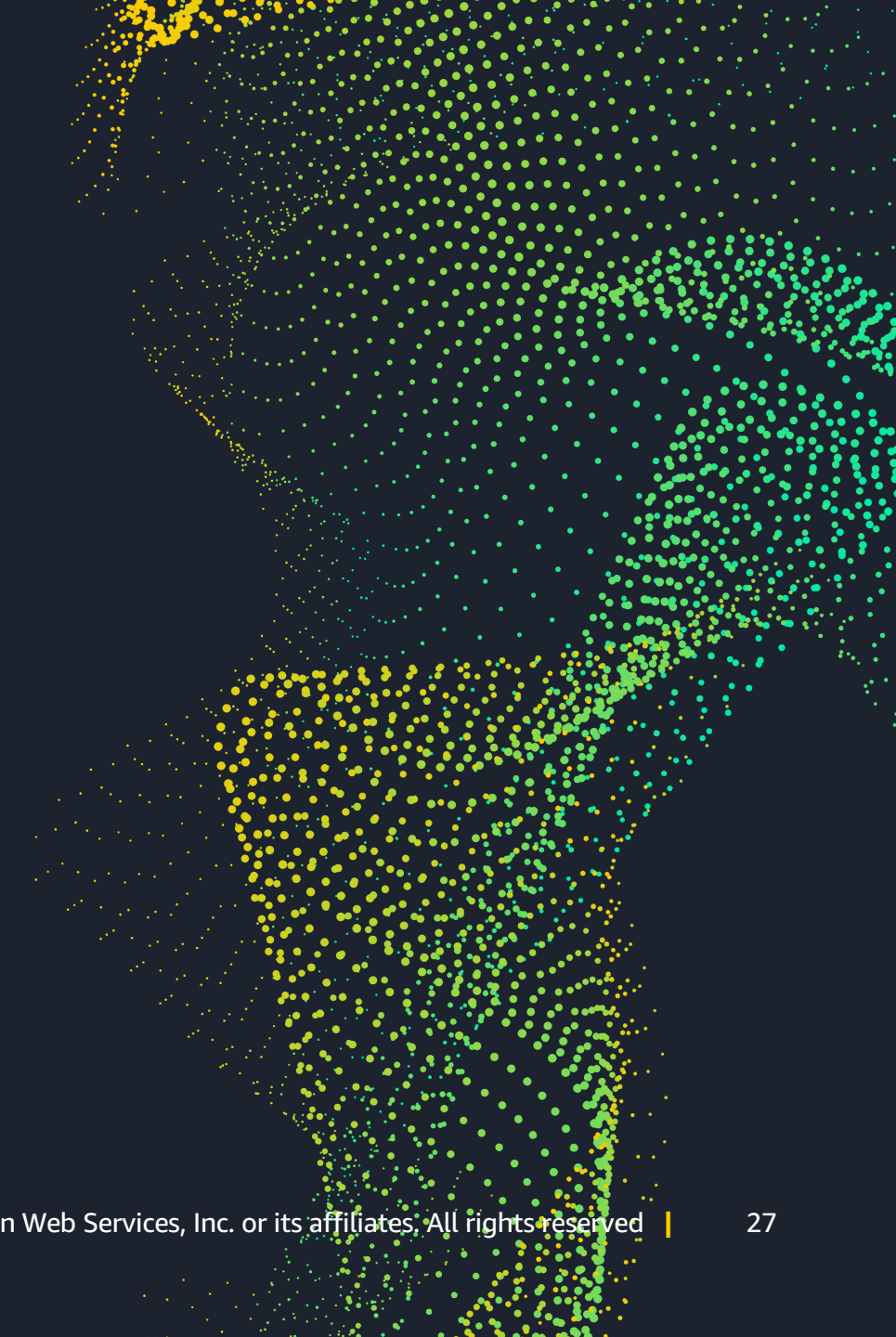
AWS AI Services Workshop



AWS AI Services Workshop

1. Get access to AWS account for this workshop: https://bit.ly/2VBfKxz

2. Follow instructions for each module:

- Build a chatbot with Amazon Lex https://bit.ly/2S1ReDs
- Use Comprehend to analyse text https://go.aws/2S0WSWj
- Describe images via Rekognition and Polly https://go.aws/2xNoWpA

Presentation will continue at 11:00. Chime channel is open for questions.

Amazon SageMaker

ML SERVICES

Amazon SageMaker

Ground Truth

ML Marketplace

SageMaker Studio IDE

Built-in algorithms	Notebooks	Experiments	Model training & tuning	Debugger	Autopilot	Model hosting	Model Monitor

Neo

Augmented AI

ML FRAMEWORKS & INFRASTRUCTURE

TensorFlow

mxnet

PYTORCH

GLUON

Keras

DeepGraphLibrary

Deep Learning AMIs & Containers | GPUs & CPUs | Elastic Inference | Inferentia | FPGA

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Introducing: 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.

Why customers choose Amazon SageMaker

REDUCE COSTS

At least **54%** lower TCO

Up to **70%** cost reduction for data labeling using Ground Truth

Up to **75%** cost reduction for inference with Elastic Inference

Up to **90%** cost reduction with managed spot training

SCALE AND PERFORMANCE

Up to **90%** GPU efficiency with AWS-optimized TensorFlow

Up to **2x** performance increases from model optimization with Neo

SECURITY & COMPLIANCE

SOC, PCI/DSS, ISO, HIPAA, C5, OSPAR, HITRUST CSF, GDPR, FIPS

EASE-OF-USE

Single IDE

Perform all ML steps in a web-based interface

Integrate with Kubernetes

Train and deploy models in SageMaker using Kubernetes operators and pipelines

One-click

model training and deployment

Train once

run anywhere

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Amazon SageMaker offers 54% lower TCO over 3 years

Amazon SageMaker offers 10x more developer productivity

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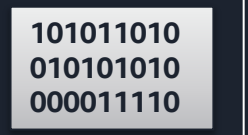
The machine learning workflow is iterative and complex

Prepare



Collect and prepare training data

Build

Choose or build an ML algorithm

Train & Tune

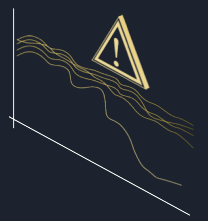
Set up and manage environments for training

Train, debug, and tune models

Manage training runs

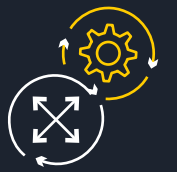
Deploy & Manage

Deploy model in production



Monitor models

Validate predictions



Scale and manage the production environment

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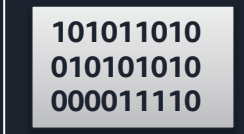
Amazon SageMaker helps you build, train, and deploy models

Prepare **Build** **Train & Tune** **Deploy & Manage**

Web-based IDE for machine learning

Automatically build and train models

Fully managed data processing jobs and data labeling workflows



Collect and prepare training data

One-click collaborative notebooks and built-in, high performance algorithms and models

Choose or bring your own ML algorithm

One-click training

Set up and manage environments for training

Debugging and optimization

Train, debug, and tune models

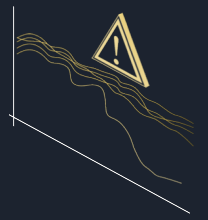
Visually track and compare experiments

Manage training runs

One-click deployment and autoscaling

Deploy model in production

Automatically spot concept drift



Monitor models

Add human review of predictions

Validate predictions

Fully managed with auto-scaling for 75% less

Scale and manage the production environment

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Amazon SageMaker helps you build, train, and deploy models

Prepare | **Build** | **Train & Tune** | **Deploy & Manage**

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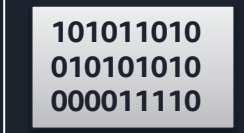

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Scale and manage the production environment

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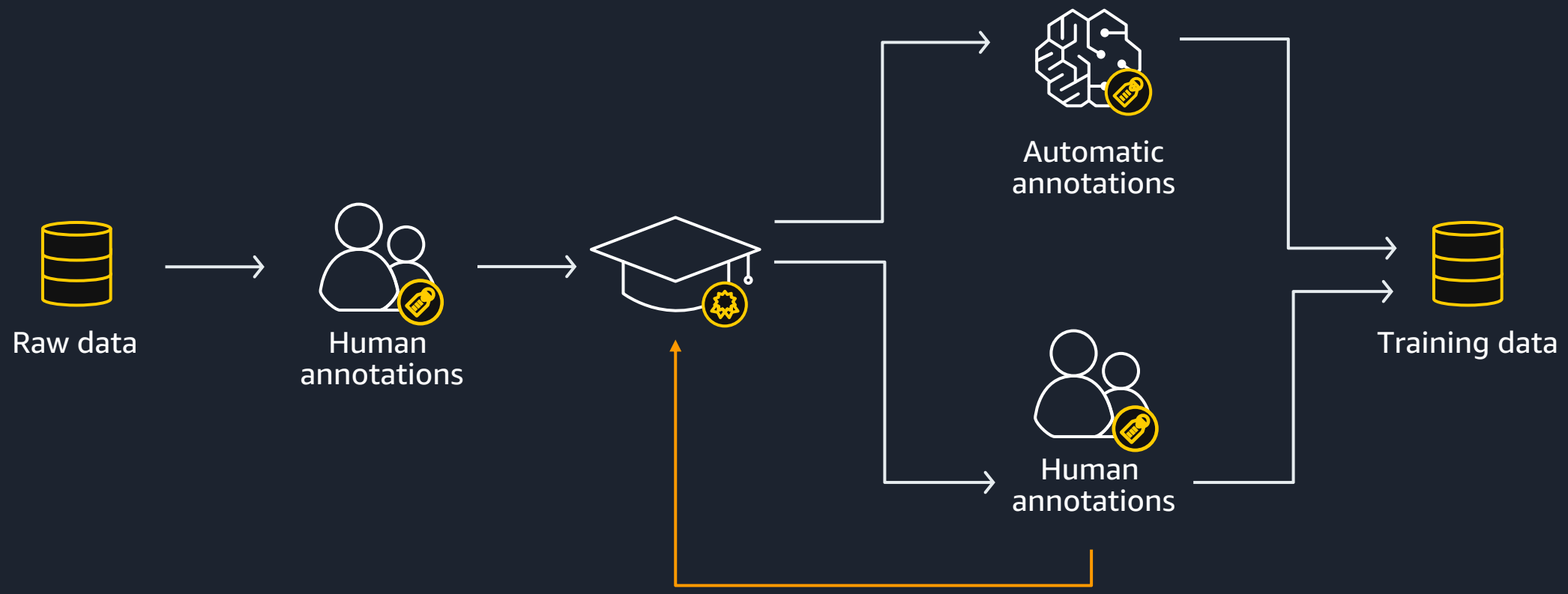
Amazon SageMaker Ground Truth

Build highly accurate training datasets using machine learning

- Reduce data labeling costs by up to 70%
- Access labelers through Amazon Mechanical Turk, Amazon approved vendors, or use private human labelers
- Achieve accurate results quickly

How Amazon SageMaker Ground Truth Works



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Task selection

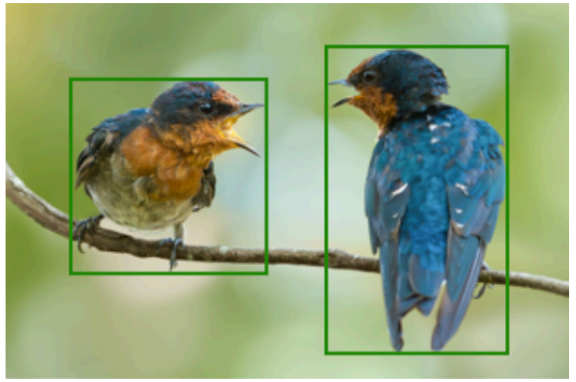
Select the task that a human worker will perform to label objects in your dataset.

Image classification

Get workers to categorize images into specific classes. Info

Bounding box

Get workers to draw bounding boxes around specified objects in your images. Info



Text classification

Get workers to categorize text into specific classes. Info

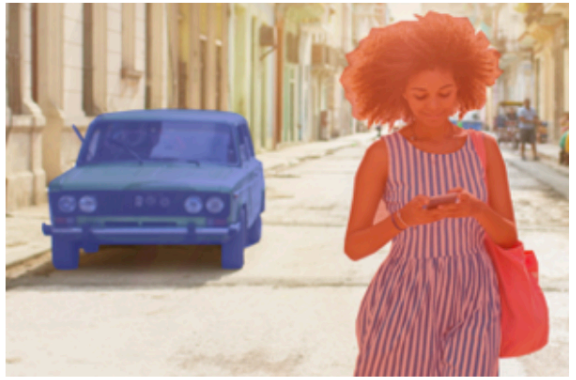
Positive

Negative

'The movie tells a lovely and wise story with honesty and has been acted out with unassuming grace.'

Semantic segmentation

Get workers to draw pixel level labels around specific objects and segments in your images. Info



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Amazon SageMaker Processing (Batch transform)

Analytics jobs for data processing and model evaluation

Fully managed

Achieve distributed processing for clusters

Custom processing

Bring your own script for feature engineering

Container support

Use SageMaker's built-in containers or bring your own

Security and compliance

Leverage SageMaker's security & compliance features

Automatic creation & termination

Your resources are created, configured, & terminated automatically

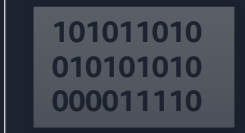
Amazon SageMaker helps you build, train, and deploy models

Prepare | **Build** | **Train & Tune** | **Deploy & Manage**

Web-based IDE for machine learning

Automatically build and train models

Fully managed data processing jobs and data labeling workflows



Collect and prepare training data

One-click collaborative notebooks and built-in, high performance algorithms and models

Choose or build an ML algorithm

One-click training

Set up and manage environments for training

Debugging and optimization

Train, debug, and tune models

Visually track and compare experiments

Manage training runs

One-click deployment and autoscaling

Deploy model in production

Automatically spot concept drift

Monitor models

Add human review of predictions

Validate predictions

Fully managed with auto-scaling for 75% less

Scale and manage the production environment

aws machine learning

 |

Amazon SageMaker Notebooks

Easy access with Single Sign-On (SSO)

Access your notebooks in seconds

Fully managed and secure

Administrators manage access and permissions

Fast setup

Start your notebooks without spinning up compute resources

Easy collaboration

Share notebooks with a single click

Flexible

Dial up or down compute resources (coming soon)

Amazon SageMaker has built-in algorithms or bring your own

Classification

- Linear Learner
- XGBoost
- KNN

Working with Text

- BlazingText
- Supervised
- Unsupervised

Sequence Translation

- Seq2Seq

Computer Vision

- Image Classification
- Object Detection
- Semantic Segmentation

Recommendation

- Factorization Machines

Anomaly Detection

- Random Cut Forests
- IP Insights

Regression

- Linear Learner
- KNN
- XGBoost

Topic Modeling

- LDA
- NTM

Forecasting

- DeepAR

Clustering

- KMeans

Feature Reduction

- PCA
- Object2Vec

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AWS Marketplace: Hundreds of algorithms, models, and data

SELLERS

Automatic labeling via machine learning

IP protection

Automated billing and metering

BUYERS

Broad selection of paid, free, and open-source algorithms and models

Data protection

Discoverable on your AWS bill

Natural language processing	Ranking	Text OCR	Computer vision	Named entity recognition	Video classification
Speech recognition	Text-to-speech	3D images	Text classification	Speaker identification	Anomaly detection
Text generation	Object detection	Regression	Text clustering	Handwriting recognition	Grammar and parsing

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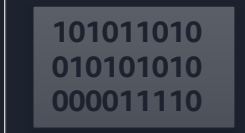
Amazon SageMaker helps you build, train, and deploy models

Prepare | **Build** | **Train & Tune** | **Deploy & Manage**

Web-based IDE for machine learning

Automatically build and train models

Fully managed data processing jobs and data labeling workflows



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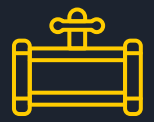
Train your model with one click using Amazon SageMaker

Train with your own algorithms

Distributed by default



Train on a data stream

Single pass training

Not memory bound

Checkpoint for re-training

Amazon SageMaker Automatic Model Tuning

Automatically tune hyperparameters in your algorithms

Tuning at scale

Adjust thousands of different combinations of algorithm parameters

Automated

Uses ML to find the best parameters

Faster

Eliminate days or weeks of tedious manual work

Examples

Decision Trees	Neural Networks
Tree depth	Number of layers
Max leaf nodes	Hidden layer width
Gamma	Learning rate
Eta	Embedding dimensions
Lambda	Dropout
Alpha	

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Web-based IDE for machine learning

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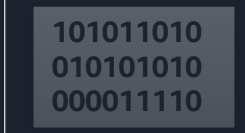

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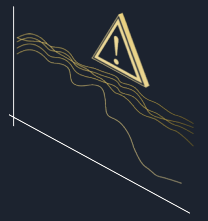

Monitor models

Add human review of predictions

Validate predictions

Fully managed with auto-scaling for 75% less

Scale and manage the production environment

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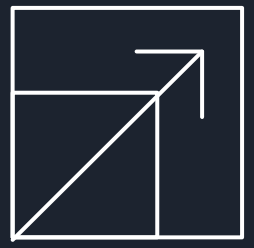
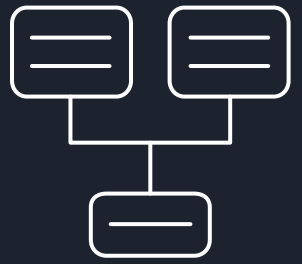
Amazon SageMaker is fully managed

One click model deployment



Auto-scaling

Low latency and high throughput

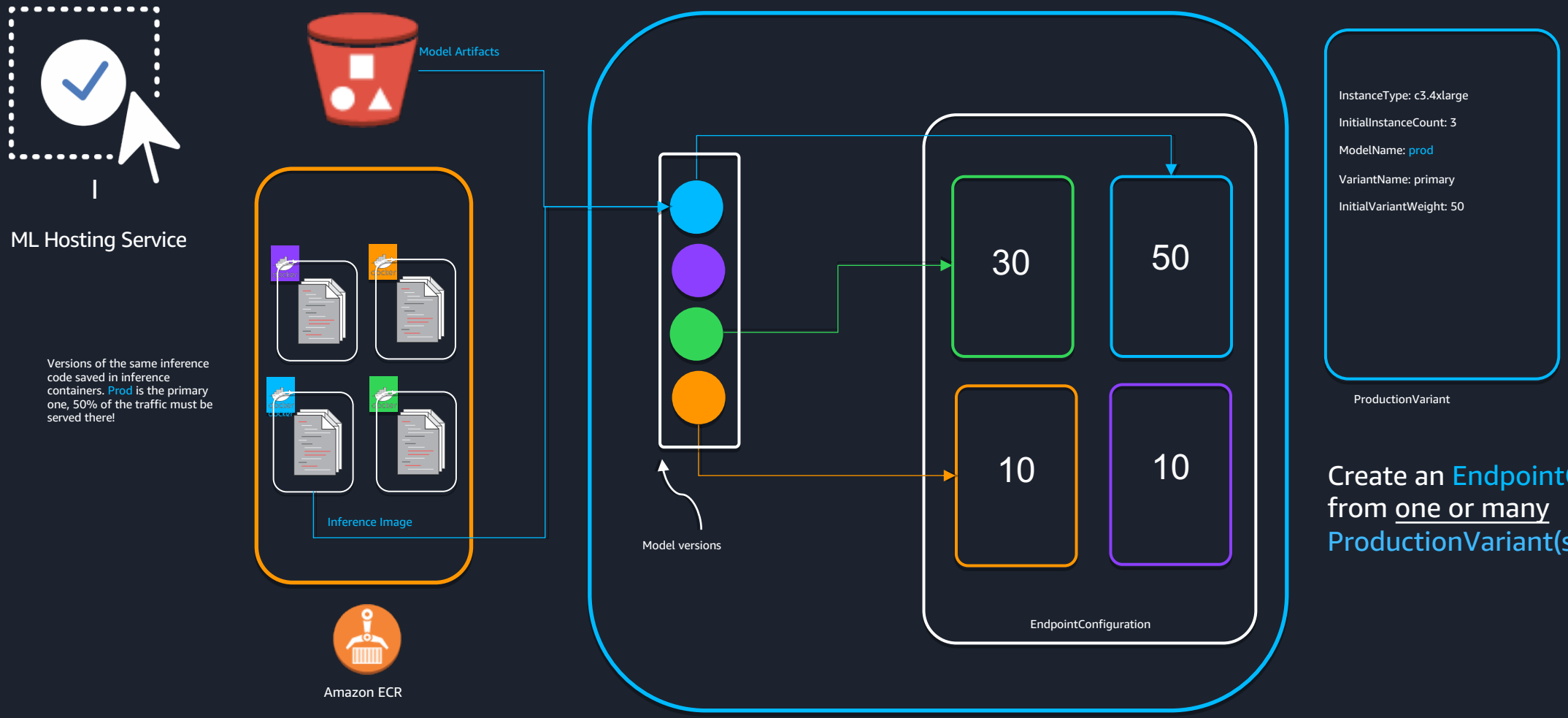


Bring your own model

Python SDK

Deploy multiple models on an endpoint

Easy Model Deployment to Amazon SageMaker



Create an EndpointConfiguration from one or many ProductionVariant(s)

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Amazon SageMaker Model Monitor

Continuous monitoring of models in production

Automatic data collection

Data is automatically collected from your endpoints

Continuous Monitoring

Define a monitoring schedule and detect changes in quality against a pre-defined baseline

Flexibility with rules

Use built-in rules to detect data drift or write your own rules for custom analysis

Visual data analysis

See monitoring results, data statistics, and violation reports in SageMaker Studio

CloudWatch Integration

Automate corrective actions based on Amazon CloudWatch alerts

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Introduction to SageMaker Workshop

Introduction to SageMaker Workshop

1. Go to this link and review the prerequisites:
   https://github.com/awslabs/amazon-sagemaker-workshop

2. Go to the "Introduction to Amazon SageMaker" workshop.

3. Complete the preliminaries, download the repository, create a Notebook Instance.

4. Continue on through the use case modules:

- Structured Data Use Case – Videogame Sales: use the XGBoost algorithm to predict whether a videogame will be a hit.

- Computer Vision Use Case – Image Classification: use SageMaker's built-in Image Classification algorithm to classify images.

Lunch break: 12:00–13:00. Chime channel is open for questions.

Time for a quizz

Join at **www.kahoot.it** or with the **Kahoot! App** with Game PIN:

464 719

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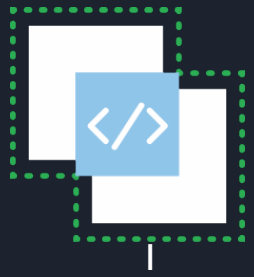
Amazon SageMaker

Notebook Instances

Algorithms



ML Training Service

ML Hosting Service

Pipe Mode

- Data flows on-the-fly during training
- Shorter startup times
- Higher I/O throughput with optimized agent
- No dataset size limits
- Requires protobuf recordIO format
- Available algorithms:
  - Principal Component Analysis (PCA)
  - K-Means Clustering
  - Factorization Machines
  - Latent Dirichlet Allocation (LDA)
  - Linear Learner (Classification and Regression)
  - Neural Topic Modelling
  - Random Cut Forest
- Or use it with your own algorithms!

PCA + K-Means on NY Taxi Dataset

https://aws.amazon.com/blogs/machine-learning/using-pipe-input-mode-for-amazon-sagemaker-algorithms/

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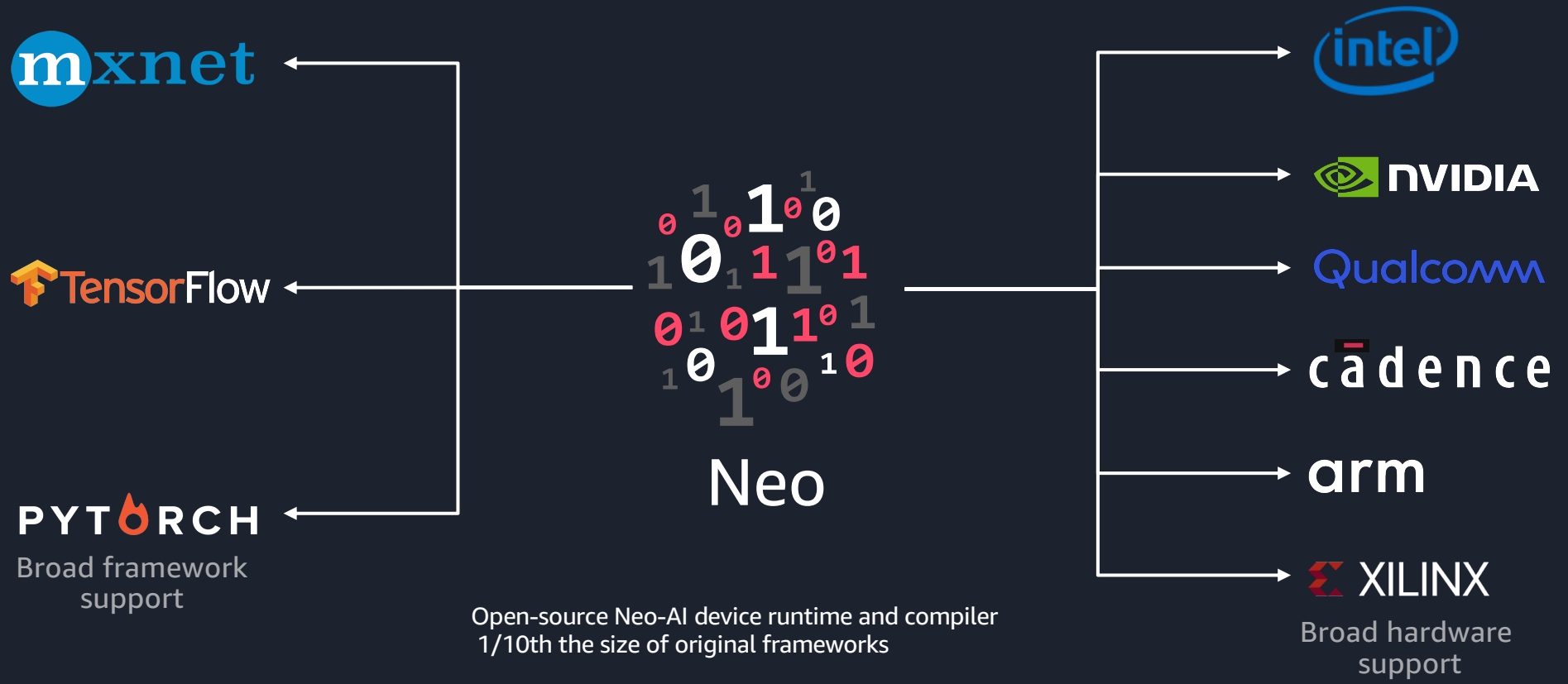
Amazon SageMaker Neo

Train once and run anywhere with 2x performance



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Highest-performing infrastructure for your business

ML FRAMEWORKS & INFRASTRUCTURE

Frameworks

TensorFlow

mxnet

PYTORCH

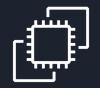
Interfaces

GLUON

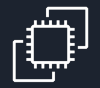
Keras

Infrastructure

EC2 P3 & P3N



EC2 C5



FPGAs

GREENGRASS

ELASTIC INFERENCE

Build custom algorithms using the ML frameworks

Fastest and lowest-cost compute options for ML workloads

Elastic compute to provision just-right compute for your ML workloads

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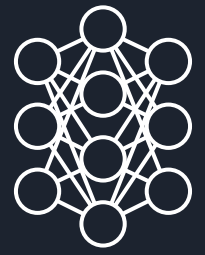
Amazon EC2 P3dn instance

The largest P3 instance, optimized for distributed training

Reduce machine learning training time

Better GPU utilization

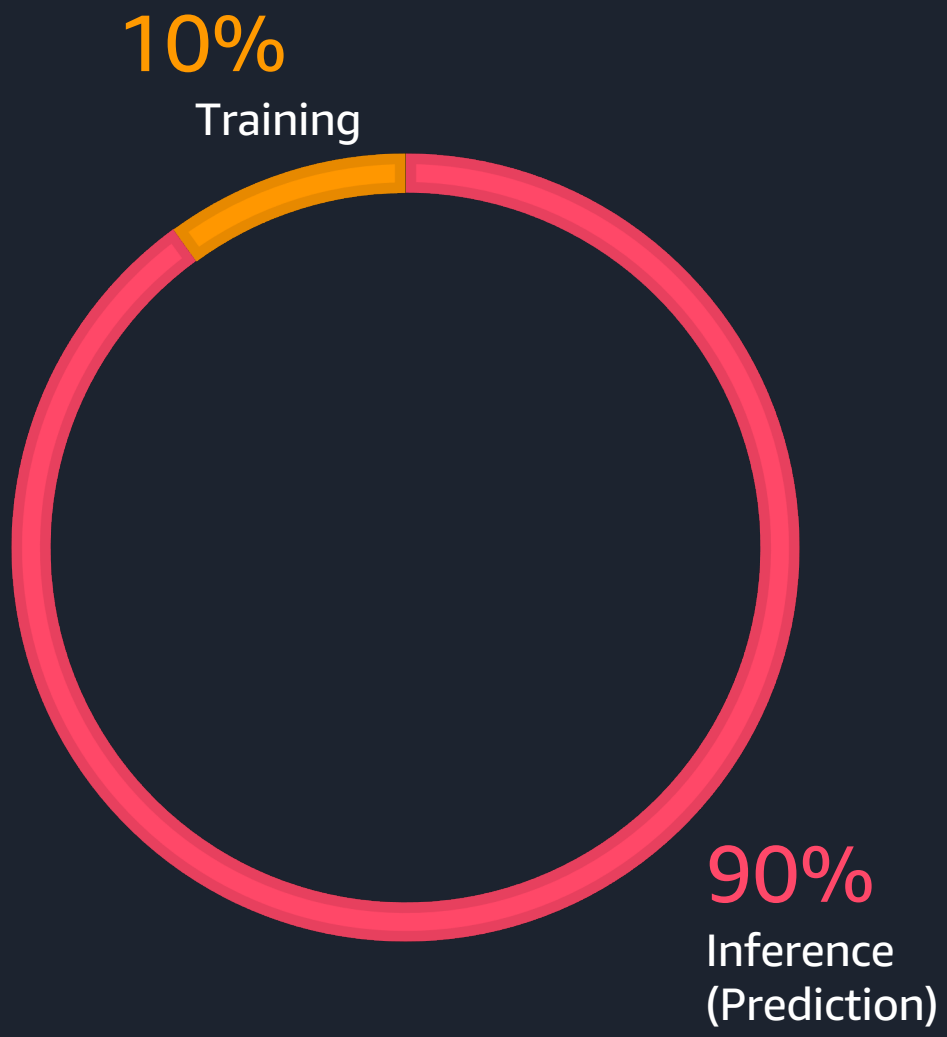


Support larger, more complex models

KEY FEATURES

100Gbps of networking bandwidth	8 NVIDIA Tesla V100 GPUs	32GB of memory per GPU (2x more P3)	96 Intel Skylake vCPUs (50% more than P3) with AVX-512

Predictions drive complexity and cost in production



Amazon Elastic Inference

Reduce deep learning inference costs up to 75%

Lower inference costs

Match capacity to demand

Available between 1 to 32 TFLOPS per accelerator

Integrated with Amazon EC2 and Amazon SageMaker

AUTODESK.

Support for TensorFlow, Apache MXNet

PyTorch (coming soon)

EAGLEVIEW TECHNOLOGIES

Single and mixed-precision operations

gumgum

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TensorFlow ♡ Amazon SageMaker

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AWS is framework agnostic

Choose from popular frameworks

TensorFlow mxnet PYTORCH Chainer Caffe2 ONNX Keras GLUON

Run them fully managed

Or run them yourself

 |

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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

Amazon SageMaker is the best place to run TensorFlow

- Fully-managed training and hosting
- Near-linear scaling across 100s of GPUs
- 3x faster network throughput with EC2 P3

65% Stock TensorFlow

90% AWS-optimized TensorFlow

Scaling efficiency with 256 GPUs

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TensorFlow in SageMaker Workshop

TensorFlow in SageMaker Workshop

1. Go to this link and review the prerequisites:
   https://github.com/awslabs/amazon-sagemaker-workshop

2. Go to the "TensorFlow in Amazon SageMaker" workshop.

3. If needed, complete the preliminaries, download the repository, create a Notebook Instance.

4. Continue on through the use case module:

- Structured Data Use Case – Boston Housing: while training a regression MLP to predict house prices, use Automatic Model Tuning to find the best hyperparameters.

Closing notes and Q&A at 16:00. Chime channel is open for questions.

The AWS ML Stack

AI SERVICES

VISION	SPEECH		TEXT			SEARCH	CHATBOTS	PERSONALIZATION	FORECASTING	FRAUD	DEVELOPMENT	CONTACT CENTERS
Amazon Rekognition	Amazon Polly	Amazon Transcribe *+Medical*	Amazon Comprehend *+Medical*	Amazon Translate	Amazon Textract	Amazon Kendra	Amazon Lex	Amazon Personalize	Amazon Forecast	Amazon Fraud Detector	Amazon CodeGuru	Contact Lens *For Amazon Connect*

ML SERVICES

Amazon SageMaker	Ground Truth	ML Marketplace	SageMaker Studio IDE							Neo	Augmented AI
			Built-in algorithms	Notebooks	Experiments	Model training & tuning	Debugger	Autopilot	Model hosting	Model Monitor	

ML FRAMEWORKS & INFRASTRUCTURE

TensorFlow · mxnet · PYTORCH · GLUON · Keras · DeepGraphLibrary · Deep Learning AMIs & Containers | GPUs & CPUs | Elastic Inference | Inferentia | FPGA

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AWS Well-Architected Framework
Machine Learning Lens

Framework is based on five pillars — operational excellence, security, reliability, performance efficiency, and cost optimization.

https://aws.amazon.com/architecture/well-architected/

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Thank you!

Please fill out the survey: https://bit.ly/2Y29QqG

@yegortokmakov

@awscloud

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