Machine Learning on AWS

Putting ML in the hands of every developer

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Beseye

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Agenda

Why machine learning

Introducing AWS machine learning stack

Partner Solutions – Beseye

Q/A
Why machine learning

Top 3 Benefits

- Better products: 50%
- Better operations: 40%
- Better decisions: 30%

Source: Deloitte State of AI in the Enterprise, 2nd Edition, 2018
Why machine learning is hard

Top 3 Challenges

- Implementation
- Integration
- Data

Source: Deloitte State of AI in the Enterprise, 2nd Edition, 2018
What is AI/ML/DL?

**Artificial intelligence**
Any technique that enables computers to mimic human intelligence using logic, if-then statements, and ML (including deep learning)

**Machine learning**
Subset of AI that uses machines to search for patterns in data to build logic models automatically

**Deep learning**
Subset of ML composed of deeply multi-layered neural networks that perform tasks like speech and image recognition
The reach of ML is growing
Our mission at AWS

Put machine learning in the hands of every developer
WHY AWS FOR ML?

- **Broatest and deepest set of AI and ML services**
  - 200+ new features and services launched this last year alone
  - Solutions for everyone from ML scientists to application developers
  - Support all three of the major frameworks

- **Accelerate your adoption of ML with SageMaker**
  - Single IDE for the entire ML workflow
  - At least 54% lower TCO
  - Up to 70% cost reduction in data-labeling
  - Up to 90% cost reduction with managed spot training

- **Built on the most comprehensive cloud platform**
  - Highly secure, reliable, fully featured data store
  - The strongest set of compute, storage, security, database, and analytics capabilities to build upon
  - 85% TensorFlow in the cloud runs on AWS
AMAZON’S MACHINE LEARNING INNOVATION
The AWS ML Stack

Broadest and most complete set of Machine Learning capabilities

AI SERVICES

**VISION**
- Amazon Rekognition
- Amazon Polly
- Amazon Transcribe
- Amazon Comprehend
- Amazon Translate
- Amazon Textract

**TEXT**
- Amazon Kendra
- Amazon Lex

**SEARCH**
- Amazon Personalize

**CHATBOTS**
- Amazon Forecast

**PERSONALIZATION**
- Amazon Fraud Detector

**FORECASTING**
- Amazon CodeGuru

**FRAUD**
- Contact Lens

**DEVELOPMENT**

**CONTACT CENTERS**

ML SERVICES

Amazon SageMaker
- Ground Truth
- AWS Marketplace for ML

SageMaker Studio IDE
- Built-in algorithms
- Notebooks
- Experiments
- Processing
- Model training & tuning
- Debugger
- Autopilot
- Model hosting
- Model Monitor

ML FRAMEWORKS & INFRASTRUCTURE

- TensorFlow
- mxnet
- PyTorch
- GLUON
- Keras
- Deep Learning AMIs & Containers
- GPUs & CPUs
- Elastic Inference
- Inferentia
- FPGA

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The AWS ML Stack

Broadest and most complete set of Machine Learning capabilities
Machine learning workflow

Collect and prepare training data
Choose and optimize your ML algorithm
Set up and manage environments for training
Train and tune ML models
Deploy models in production
Scale and manage the production environment
Build, train, and deploy models with Amazon SageMaker

**Build**
- Fast, accurate labeling
- Fully managed notebooks

**Train**
- One-click training
- Automatic model tuning

**Deploy**
- One-click deployment
- Fully managed Auto Scaling

Collect and prepare training data
Choose and optimize algorithm
Manage training environments
Train and tune ML models
Deploy models in production
Scale 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
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 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

**Topic Modeling**
- LDA
- NTM

**Forecasting**
- DeepAR

**Clustering**
- KMeans

**Feature Reduction**
- PCA
- Object2Vec

**Regression**
- Linear Learner
- XGBoost
- KNN
AWS Marketplace for Machine Learning

You can shop for algorithms, models, and data in AWS Marketplace for ML

Browse or search AWS Marketplace
Subscribe in a single click
Available in Amazon SageMaker

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Hundreds of algorithms, models, and data

<table>
<thead>
<tr>
<th>SELLERS</th>
<th>BUYERS</th>
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<tbody>
<tr>
<td>Automatic labeling via machine learning</td>
<td>Broad selection of paid, free, and open-source algorithms and models</td>
</tr>
<tr>
<td>IP protection</td>
<td>Data protection</td>
</tr>
<tr>
<td>Automated billing and metering</td>
<td>Discoverable on your AWS bill</td>
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</table>

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

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Successful models require high-quality data
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

Raw data → Human annotations → Automatic annotations → Training data

Human annotations

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Machine learning is iterative

- Build: Build models in notebooks
- Set up and track experiment
- Train: Train and tune models
- Choose model
- Deploy: Deploy and scale models
- Monitor quality, detect drift, and retrain
- Debug, compare, and evaluate experiments
- Share, review, and collaborate
Introducing Amazon SageMaker Studio

- **Amazon SageMaker Notebooks**
  Quick start collaborative notebooks

- **Amazon SageMaker Experiments**
  Organize, track, and compare ML experiments

- **Amazon SageMaker Debugger**
  Debug models with real-time, automated alerts

- **Amazon SageMaker Model Monitor**
  Monitor models in production and detect drift

- **Amazon SageMaker Autopilot**
  Get from data to models automatically
Build fast and collaborate

Build
Build models in notebooks

Set up and track experiment

Train
Train and tune models

Choose model

Deploy
Deploy and scale models

Monitor quality, detect drift, and retrain

Debug, compare, and evaluate experiments

Share, review, and collaborate
Quick Start collaborative Amazon SageMaker Notebooks

- Single sign-on
- Secure
- Switch compute environments
- One-click share
- Reproducible notebooks

- Integrated with AWS SSO
- Administrators govern access and permissions
- Switch compute instances on the fly
- Share URL with a single click
- Easily reproduce and review notebooks
Manage Experiments

- **Build**: Build models in notebooks
  - Share, review, and collaborate
  - Set up and track experiment

- **Train**: Train and Tune models
  - Compare and evaluate experiments
  - Monitor quality, detect drifts, and retrain

- **Deploy**: Deploy and scale models
  - Choose model
Amazon SageMaker Experiments

Track experiments
Track parameters, metrics, models, and more

Organize
Organize your experiments and trials

Compare experiments
Compare, evaluate, and iterate

Python SDK
Tracking and analytics APIs
Debug training runs

- Build
  - Build models in notebooks

- Set-up and track experiment

- Train
  - Train and tune models
  - Compare, evaluate, and pick model

- Deploy
  - Deploy and scale models
  - Monitor quality, detect drift, and retrain

- Debug experiments

Share, review, and collaborate
Amazon SageMaker Debugger

Framework support
TensorFlow, Apache MXNet, PyTorch, XGBoost

Introspect models
Introspects, collects and analyzes tensors

Rules and Alerts
Provides real-time alerts when bottleneck is identified

Python SDK
Write your own debug rules

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Monitor models

- Build: Build models in notebooks
  - Share, review, and collaborate
- Set up and track experiment
- Train: Train and tune models
- Choose model
- Deploy: Deploy and scale models
  - Monitor quality, detect drift, and retrain
- Debug, compare, and evaluate experiments
Amazon SageMaker Model Monitor

Collect data
Periodically collects data from endpoints into Amazon S3

Analyze
Computes feature statistics

Monitor
Monitors trends in data and detects drifts

Alerts
Alerts on Amazon CloudWatch and Amazon SageMaker Studio

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How else can we accelerate ML workflow?

- Build: Build models in notebooks
- Set up and track experiment
- Train: Train and tune models
- Choose model
- Deploy: Deploy and scale models
- Debug, compare, and evaluate experiments
- Monitor quality, detect drift, and retrain
- Share, review, and collaborate
Amazon SageMaker Autopilot

- **Provide data**: Data in tabular form
- **Specify column to predict**: Support for regression and classification
- **Create model**: Feature generation, algorithm selection, and parameter tuning
- **Track experiment**: Automatically tracked as an experiment
- **Transparent**: Get notebook with source code
The AWS ML Stack

Broadest and most complete set of Machine Learning capabilities

**AI SERVICES**

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<td>For Amazon Connect</td>
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**ML SERVICES**

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- Augmented AI
- ML Marketplace

SageMaker Studio IDE

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**ML FRAMEWORKS & INFRASTRUCTURE**

- TensorFlow
- mxnet
- GLUON
- Keras
- PyTorch
- Deep Learning AMIs & Containers
- GPUs & CPUs
- Elastic Inference
- Inferentia (Inf1 instance)
- FPGA

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Amazon Fraud Detector
Automate online fraud detection

- Pre-built fraud detection model templates
- Automatic creation of custom fraud detection models
- Models learn from past attempts to defraud Amazon
- Amazon SageMaker integration
- One interface to review past evaluations and detection logic

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Contact Lens for Amazon Connect
Better insights lead to better customer service

- Transcribes live and archived calls
- Enhanced search on call and chat transcripts, sentiment scores, silence duration etc.
- Custom categorization to identify common call types
- Prioritized list of recurring issues based on customer feedback
- Real time dashboard and alerting for supervisors
- Provide agents with answers to questions as they are being asked
Transcribe Medical + Comprehend Medical

Amazon Transcribe Medical (ASR)
- Accurately transcribe conversations during patient encounters in real time
- Accurately transcribe medical dictation after patient encounter in real time

Text output

Amazon Comprehend Medical (NLP)
- Text analysis
- Electronic health record (EHR) system
Tens of thousands customers have chosen AWS for their ML workloads | More than twice as many customers using ML than any other cloud provider
Building a digital voice scribe

By leveraging Amazon Transcribe Medical's transcription API, Cerner is in initial development of a digital voice scribe that automatically listens to clinician-patient interactions and unobtrusively captures the dialogue in text form.
Defect Detection w/ML

Problem

FST seek yield improvement in their silicon wafer factories. The current defect detection process is good but it involve significant human inspection efforts.

Solution

FST would like to partner with AWS to push the yield envelope with AI/ML. We conducted ML workshop and hackathon to educate the teams on the latest AWS technologies. We then worked together to create the ML silicon defect detection model using tens of thousands of wafer images for training.

Impact

We finally create a ML defect detection model with 99%+ detection rate (aka., Recall Rate), improved yield and reduced the human inspection efforts by half.

“AWS not only is the ML expert with advanced capable tools but also our partner to show us how to use them to improve our production operations.

AWS 不只是提供先進機器學習工具的專家，更是教學我們如何在應用的合作伙伴。

Jason Lin
Chairman, Formosa Sumco Technology Corporation
Learn ML with AWS Training and Certification

The same training that our own developers use, now available on demand

Role-based ML learning paths for developers, data scientists, data platform engineers, and business decision makers

70+ free digital ML courses from AWS experts let you learn from real-world challenges tackled at AWS

Validate expertise with the AWS Certified Machine Learning - Specialty exam

Visit https://aws.training/machinelearning
Remember to complete your evaluations!
Beseye

AI Security Camera Platform

Marketing Sales Manager
Boy Lee
Agenda

• About Beseye

• Beseye Skeleton-Print™ Technology

• Show Cases
  • Railway
  • Retail
  • Factory

• High Level Structure in AWS
Our Growth

2015
- World’s No.1 iF, REDDOT Awards, Germany
- CVS

2017
- Japan’s Tier-1
- Tokyu Techno Railway
- Far EasTone
- Chunghwa Telecom

2019
- Japan’s Tier-1 CVS
- Japan second large steel company JFE
Due to NDA restriction, some key customers are not listed on this slide: Including 3rd largest mobile brand, largest department store in Taiwan.
Core Technology

Computer Vision

Object Recognition
Facial Recognition

Beseye Skeleton-Print Technology
AI Platform Overview

IP Cameras

Chain Stores
Public Transportation
Factory
Bank / Hospital

Beseye AI Video Platform

Security Analytics
Invasion Detection
Suspicious Behavior
...

Customer Analytics
Customer Demographics
Customer Satisfactions
...
Benchmark
Leading AI Skeleton-Print Tech. at 5-Meter Distance
• Improve > 30% Accuracy
AI Deep Learning Engine

Skeleton-Print Analysis
Facial Analysis
Background Analysis
Beseye AI Video Analysis Platform
For Railway
Beseye AI Engine (Railway Scenario)
Benefit for Tokyu Techno

- Accident Rate: -30%
- Surveillance Cost: -40%
Beseye AI Engine (Railway Scenario)
Beseye AI Engine (Railway Scenario)
Beseye AI Video Analysis Platform
For Retail
Retail Stores

- On-line Promotions
- Off-line Promotions
- Passerby

Conversion %

POS Results

Customer Behavior

Retail Stores

Shelf 1

Shelf 2

Shelf 3

Shelf 4

Shopping
Beseye AI Engine  (Products Interaction)
Beseye AI Engine (Demographics & VIP)
Beseye AI Engine (Route and Dwell time)
Beseye AI Video Analysis Platform
For Factory/ Manufacturing
Challenges To Keep A Factory Working

- Smooth Production Line
- Workers Are Safe
- Factory Is Safe
Production Line Analysis
Challenges In Production Line

Products, Which Require High Level of Human Force Involvement During Production.

- Workers Don’t Always Follow SOP.
- Foreman Can’t Monitor Every Worker All The Time.
- Supervisor Realizes Low Productivity Only By Result. No Tool To Dig Out The Reason And Improve.

Production Target Fail, OT, Quality Issue → Additional Cost
Safety Analysis
Every Accident Is Additional Cost

Safety Analysis

Danger Zone

Suspicious Behavior Detection

Workers’ Safety & Factory’s Safety
Transform into Smart Environments

- Annunciation Lamp
- AI Cameras
- Machine Switch

ID: 0134
LOC.: 04
BEHAVIOR: Too Close to The Danger Area
Suspicious Behavior Detection

LOC.: Backyard
BEHAVIOR: Walking
ABNORMALITY: Face Coverage

LOC.: Loading Dock
BEHAVIOR: Walking
ABNORMALITY: Human Detected In Off-hour
Beseye AI Solution

Behavior
- Fall
- Drunk

Who
- Old Man
- Young Man

Location
- Railway
- Factory

Skeleton-Print

Facial Analysis

Background Analysis
Product Model

Turnkey Solution
- Beseye Camera
- Beseye AI Platform Service

Open Platform Solution
- Beseye AI Platform Service

Cloud OR Local
High Level Structure in AWS
Thank you