Introduction to machine learning with AWS

Ahmer Memon
Senior Solutions Architect
AWS
The reach of ML is growing

**INCREASED SPENDING**
By 2026, global spending on artificial intelligence will reach $300 billion growing 4.2 faster than average IT spend

*IDC*

https://www.idc.com/getdoc.jsp?containerId=prUS49670322

**AI ACROSS SEVERAL BUSINESS UNITS**
Gartner survey reveals 80% of executives think automation can be applied to any business decision

*Gartner*

Gartner, Press Release
https://bit.ly/3is16a2

**AI IS CRITICAL TO SUCCESS**
94% of business leaders surveyed say AI is critical to their success

*Deloitte*

Deloitte, “State of AI in the Enterprise,”
https://bit.ly/3XiNOLR
What is it?

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

**Machine learning (ML)**
A subset of AI that uses machines to search for patterns in data to build logic models automatically

**Deep learning (DL)**
A subset of ML composed of deeply multi-layered neural networks that perform tasks like speech and image recognition

**Reinforcement learning (RL)**
Reinforcement learning trains models by using a reward function of a desired outcome
Amazon machine learning innovation at scale

4,000 products per minute sold on Amazon.com

1.6 million packages every day

Billions of Alexa interactions each week

First Prime Air delivery on December 7, 2016
Enhance customer experience
Better and faster decision-making
Improve business operations
New products and services
Intelligent document processing
Content moderation
Predictive Maintenance
Machine translation
MLOps
Coding & DevOps

New use cases

Contact center intelligence
Chatbots and virtual assistants
Personalization
Identity verification
Fraud prevention

Intelligent search
Forecasting
Lead scoring
Churn prediction

Enhance customer experience
Better and faster decision-making
Improve business operations
New products and services
<table>
<thead>
<tr>
<th>Industry</th>
<th>Benefits</th>
</tr>
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<tbody>
<tr>
<td>Healthcare &amp; life sciences</td>
<td>Reduce costs, improve patient outcomes, and enable the discovery and manufacturing of new drugs</td>
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<tr>
<td>Industrial &amp; manufacturing</td>
<td>Implement predictive maintenance, improve workplace safety, automate visual inspection, and optimize supply chains</td>
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<tr>
<td>Financial services</td>
<td>Detect fraud, process documents faster, personalize recommendations, and perform credit decisioning</td>
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<tr>
<td>Retail</td>
<td>Personalize product recommendations, forecast demand, and predict fraud</td>
</tr>
<tr>
<td>Media &amp; entertainment</td>
<td>Accelerate content creation and curation, increase customer engagement, and improve monetization</td>
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</table>
100,000+ customers use AWS for machine learning
AI Use Case Explorer

Easily find the most relevant AI use cases with related content and guidance to make them real

aiexplorer.aws.amazon.com
The AWS AI/ML stack

BROADEST AND MOST COMPLETE SET OF MACHINE LEARNING CAPABILITIES

AI SERVICES

SPECIALIZED

BUSINESS PROCESSES
Amazon Personalize
Amazon Forecast
Amazon Fraud Detector
Amazon Lookout for Metrics

SEARCH
Amazon Kendra

CONVERSATION
Amazon Lex
Amazon Transcribe Call Analytics
Contact Lens
Voice ID

CODE + DEVOPS
Amazon CodeGuru
Amazon CodeWhisperer
Amazon DevOps Guru

INDUSTRIAL
Amazon Monitron
Amazon Lookout for Equipment
Amazon Lookout for Vision

HEALTH
Amazon HealthLake
Amazon Comprehend Medical
Amazon Transcribe Medical
Amazon Omics

CORE

TEXT
Amazon Translate
Amazon Comprehend

SPEECH
Amazon Polly
Amazon Transcribe

VISION
Amazon Textract
Amazon Rekognition
AWS Panorama

AMAZON
SAGEMAKER

CANVAS
No-code ML for business analysts

STUDIO LAB
Learn ML

GROUND TRUTH
Label data

STUDIO IDE

Prepare data
Geospatial ML

Build with notebooks
Train models
Tune parameters

Deploy in production
Manage and monitor

ML FRAMEWORKS & INFRASTRUCTURE

PyTorch, Apache MXNet, TensorFlow

Amazon EC2
Amazon Inferentia

CPUs
GPUs
AWS Trainium

AWS

Habana Gaudi
FPGA

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Common ML use cases for some verticals

- Retail: Supply chain and demand forecasting
- Financial services: Credit default prediction for customer behavior
- Manufacturing: Real-time predictions for industrial IoT
- Advertising: Predict click-through rate for targeted ads
- Automotive innovation: Self-driving vehicles and simulation
- Health and wellness: Track disease progression
The machine learning process

Problem Use Case KPI

PoC

Data Pipeline

Model Training

Model Testing

Productization & Launch

Measure & Feedback Loop
The machine learning process

SageMaker Studio

SageMaker Training

SageMaker Pipelines

SageMaker Endpoints

PoC

Data Pipeline

Model Training

Model Testing

Productization & Launch
The machine learning process

- Problem
- Use Case
- KPI

SageMaker
Model Monitor

AWS
CodePipeline

Measure & Feedback Loop
Fraud Detection Deep Dive
Fraud detection card fraud

- Class imbalance
- Concept drift
- Near real-time
- Sequential modeling
- Lack of public datasets

Fig. 1. Evolution of total value of card fraud using cards issued within SEPA. Card-not-present frauds account for the majority of reported frauds.

source: https://www.ecb.europa.eu/
Fraud detection complete system
Fraud detection solution
Fraud detection solution


or

Amazon Fraud Detector

https://aws.amazon.com/fraud-detector/
SageMaker

Build, train, and deploy ML models for any use case with fully managed infrastructure, tools, and workflows
Wanted to speed up all stages of research and development, particularly the review of tissue samples
Labeling data was time-consuming and tedious

Partnered with the Amazon ML Solutions Lab to integrate Amazon SageMaker Ground Truth to automate tedious portions of work
Helps annotate, collect and classify ML model training data quickly

Reduces time humans spend cataloging samples by at least 50%
Accelerates the drug research process and the introduction of medicines to the market
Increases the pace of research by freeing up scientists

It’s the start of a broad change in our business—using all of this imaging and molecular data along with AI to develop a holistic approach, one that lets our scientists interact and interpret the data in ways that have never been possible.

Richard Goodwin
Director for Molecular Imaging
AstraZeneca

MORE INFO: ARTICLE | CASE STUDY
Personalization

Generate personalized recommendations to increase customer engagement

Use case categories

• Deliver unique homepage experiences
• Help customers discover products faster
• Target customers more accurately
• Highlight new products, content, and promotion offerings

Benefits

• Implement a personalization engine in days, not months—no ML expertise required
• Adapt recommendations in real time
• Increase engagement and revenue through relevancy

Customer references

AI services

Solution

ML Services

Solution

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Amazon Personalize

How it works

User events/interactions
(views, signups, conversions, etc.)

Item metadata
(details of articles, products, videos, etc.)

User metadata
(age, location, etc.)

Fully managed by Amazon Personalize
When you think of e-commerce, you think of AWS.

New services are always coming out on AWS, and support is very good.

Shane Leese
Business Intelligence Director
Pomelo Fashion

MORE INFO: CASE STUDY | VIDEO
Predictive maintenance

**Improve uptime and reduce industrial costs**

**Benefits**
- Detect abnormal conditions in industrial equipment, and prevent problems before they occur
- Improve uptime of industrial equipment
- Reduce costs of unplanned downtime
- Allow reliability and maintenance engineers to make more informed decisions
- No ML experience required

**Partners**
- CloudRAIL
- SeeQ
- RADIX
- TensorIoT
- ROVISYS

**Customer references**
- Koch
- GE
- CEPSA
- Fender
- Georgia-Pacific

**Underlying AI services**
- Amazon Monitron
- Amazon Lookout for Equipment

**Solution**
- Predictive Maintenance Using Machine Learning
Forecasting

FORECAST INVENTORY, PRODUCT DEMAND, FINANCIAL METRICS, AND WORKFORCE STAFFING

Use case category
• Retail inventory forecasting
• Supply chain demand planning
• Revenue and financial metrics forecasting
• Workforce planning and staffing

Benefits
• Grow retail sales through fewer stockouts
• Lower costs by reducing wasted inventory
• Increase profitability through improved product allocation
• Optimize workforce productivity & staffing

Customer references

AI Services
Amazon Forecast

ML Services
Amazon SageMaker
SageMaker Canvas

Guidance
Improving Forecast Accuracy with ML

Solution
Demand Forecasting
Identity verification

**ENABLE SECURE AND COMPLIANT DIGITAL EXPERIENCES**

**Use case category**
- Customer onboarding & verification
- Online proctoring
- Gig economy verification
- Event & airport check-ins
- Use challenges

**Benefits**
- Reduce onboarding friction
- Reduce fraud
- Lower costs and overheads

**Customer references**
- aella
- bachpan bachao andolan
- COINJAR

**Underlying AI services**
- Amazon Rekognition
- Amazon Textract

**Guidance**
- AWS Solution Guidance
Content moderation
CREATE SAFE ONLINE ENVIRONMENTS, PROTECT YOUR BRAND, AND MINIMIZE MODERATION COSTS

Use case category
• Gaming
• Social media
• E-commerce
• Advertising

Benefits
• Improve safety for users and brands
• Streamline content moderation operations
• Increase reliability and lower costs

Customer references

Underlying AI services
Amazon Augmented AI
Amazon Rekognition
Amazon Transcribe
Amazon Comprehend
Amazon Translate

Guidance
AWS Solution Guidance
Innovate faster with the most comprehensive set of AI/ML services

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<th>AWS ADVANTAGE</th>
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<tr>
<td>AI powered use cases</td>
<td>Hundreds of pre-built algorithms, models, and solutions for common use cases and industries. Faster time to value with 23 pre-trained AI Services.</td>
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<td>Democratize access to ML</td>
<td>Empower any business analyst to make predictions without writing code with Amazon SageMaker. AI Services to easily add AI capabilities to your applications, no ML skills required.</td>
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<td>Scale ML</td>
<td>Build, train, and deploy ML models for any use case with Amazon SageMaker. Harness the exponential growth of ML models with foundation models on AWS.</td>
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<td>Grow ML skills</td>
<td>Learn more with AWS Training, AWS DeepRacer, AI &amp; ML Scholarship Program, and AWS Machine Learning University. Accelerate your journey with AWS ML Embark Program or Amazon ML Solutions Lab.</td>
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Next steps

**TRAINING**
In-person, online and certification programs
AWS deep devices

**IDEATION AND PROOF OF CONCEPT**
ML Solutions Lab
AWS ML
Embark Program

**AI SERVICES, NO ML SKILLS REQUIRED**
Leverage our AI services to add AI capabilities to your business applications

**BUILD YOUR OWN MODEL**
Build your own model using SageMaker or SageMaker Canvas
Thank you!

If you would like to follow up, our colleagues from Kreuzwerker are available to talk.

We can be found at the tables at the back of the room.