aws INNOVATE
DATA AND AI/ML EDITION

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Adding machine learning to your software engineering toolbelt

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Agenda

- Understanding the difference between AI, ML and deep learning

- Exploring development workflow similarities

- How to easily get started with AI, ML

- Practical perspective/demo of AI-powered coding companion

- Other AI tools for developers

- Building your own ML models

- Resources to get started

Let's get started!

Understanding the difference between AI, ML and deep learning

Artificial intelligence
Any technique that enables computers to mimic human intelligence using logic, if-then statements, and ML (including deep learning)
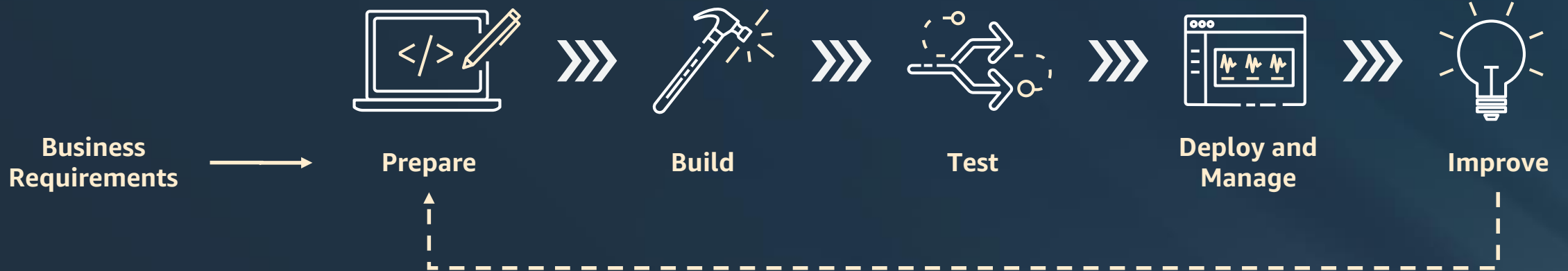
Machine learning
Subset of AI that uses machines to search for patterns in data to build logic models automatically

Deep learning
Subset of ML composed of deeply multi-layered neural networks that perform tasks like speech and image recognition

Exploring development workflow similarities

Business Requirements → Prepare »» Build »» Test »» Deploy and Manage »» Improve

Exploring development workflow similarities

PREPARE →

SageMaker Ground Truth
Label training data for machine learning

SageMaker Data Wrangler
Aggregate and prepare data for machine learning

SageMaker Processing
Built-in Python, BYO R/Spark

SageMaker Feature Store
Store, update, retrieve, and share features

SageMaker Clarify
Detect bias and understand model predictions

BUILD →

SageMaker Studio Notebooks
Jupyter notebooks with elastic compute and sharing

Built-in and Bring your-own Algorithms
Dozens of optimized algorithms or bring your own

Local Mode
Test and prototype on your local machine

SageMaker Autopilot
Automatically create machine learning models with full visibility

SageMaker JumpStart
Pre-built solutions for common use cases

TRAIN & TUNE →

Managed Training
Distributed infrastructure management

SageMaker Experiments
Capture, organize, and compare every step

Automatic Model Tuning
Hyperparameter optimization

Distributed Training Libraries
Training for large datasets and models

SageMaker Debugger
Debug and profile training runs

Managed Spot Training
Reduce training cost by 90%

DEPLOY & MANAGE →

Managed Deployment
Fully managed, ultra low latency, high throughput

Kubernetes & Kubeflow Integration
Simplify Kubernetes-based machine learning

Multi-Model Endpoints
Reduce cost by hosting multiple models per instance

SageMaker Model Monitor
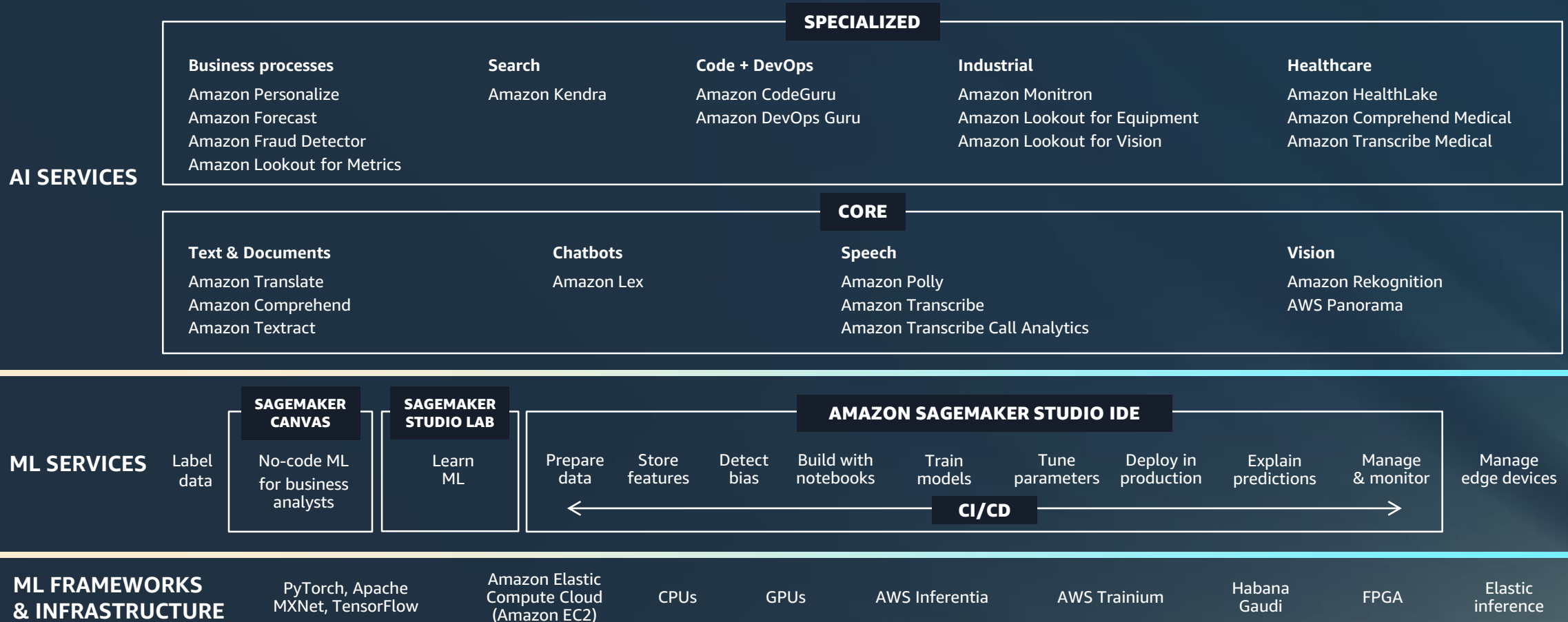Maintain accuracy of deployed models

SageMaker Edge Manager
Manage and monitor models on edge devices

SageMaker Pipelines
Workflow orchestration and automation

How to easily get started with ML

Broadest and most complete set of machine learning capabilities

AI SERVICES

SPECIALIZED

Business processes	**Search**	**Code + DevOps**	**Industrial**	**Healthcare**
Amazon Personalize	Amazon Kendra	Amazon CodeGuru	Amazon Monitron	Amazon HealthLake
Amazon Forecast		Amazon DevOps Guru	Amazon Lookout for Equipment	Amazon Comprehend Medical
Amazon Fraud Detector			Amazon Lookout for Vision	Amazon Transcribe Medical
Amazon Lookout for Metrics				

CORE

Text & Documents	**Chatbots**	**Speech**	**Vision**
Amazon Translate	Amazon Lex	Amazon Polly	Amazon Rekognition
Amazon Comprehend		Amazon Transcribe	AWS Panorama
Amazon Textract		Amazon Transcribe Call Analytics	

ML SERVICES

SAGEMAKER CANVAS

SAGEMAKER STUDIO LAB

AMAZON SAGEMAKER STUDIO IDE

Label data	No-code ML for business analysts	Learn ML	Prepare data	Store features	Detect bias	Build with notebooks	Train models	Tune parameters	Deploy in production	Explain predictions	Manage & monitor	Manage edge devices

CI/CD

ML FRAMEWORKS & INFRASTRUCTURE

PyTorch, Apache MXNet, TensorFlow	Amazon Elastic Compute Cloud (Amazon EC2)	CPUs	GPUs	AWS Inferentia	AWS Trainium	Habana Gaudi	FPGA	Elastic inference

Dive deep / practical perspective / demo AI-powered coding companion

Exploring an AI-powered coding companion

Multiple programming languages

Multiple frameworks and libraries

Numerous cloud services and APIs

Identifying relevant best practices

Amazon CodeWhisperer: AI-powered coding companion

Provides code recommendations in natural language based on contextual information like prior code and comments

GENERATES:

- Entirely new code based on context

- Code from plain English comments

- Complete functions

Available in all major integrated development environments (IDEs) as an extension

```python
# Write a function to upload a file to S3.
def upload_file_to_s3(file_name, bucket_name, object_name):
    """
    Uploads a file to an S3 bucket

    :param file_name: File to upload
    :param bucket_name: Bucket to upload to
    :param object_name: S3 object name. If none then file_name is used
    :return: True if file was uploaded, else False
    """

    # Upload the file
    s3_client = boto3.client('s3',
                             aws_access_key_id=AWS_ACCESS_KEY_ID,
                             aws_secret_access_key=AWS_SECRET_ACCESS_KEY,
                             region_name=AWS_REGION_NAME)

    try:
        s3_client.upload_file(file_name, bucket_name, object_name)
        print(f'File {file_name} uploaded to S3 bucket {bucket_name} as {object_name}')
        return True
    except FileNotFoundError:
        print(f'File {file_name} not found')
```

Amazon CodeWhisperer: AI-powered coding companion

Develop next-gen applications

Accelerate frontend and backend development by empowering developers with automatic code recommendations

Use ML in your applications

Save time and effort by using Amazon CodeWhisperer to generate code to build and train your ML models

Build applications using AWS services

Speed up the development process with code recommendations for AWS APIs across the most popular services, including Amazon EC2, AWS Lambda, and Amazon S3

Automate unit test generation

- Offload writing repetitive unit test code
- Based on natural language comments, Amazon CodeWhisperer automatically recommends unit test code that matches your implementation code

Amazon CodeWhisperer: ML-powered coding companion
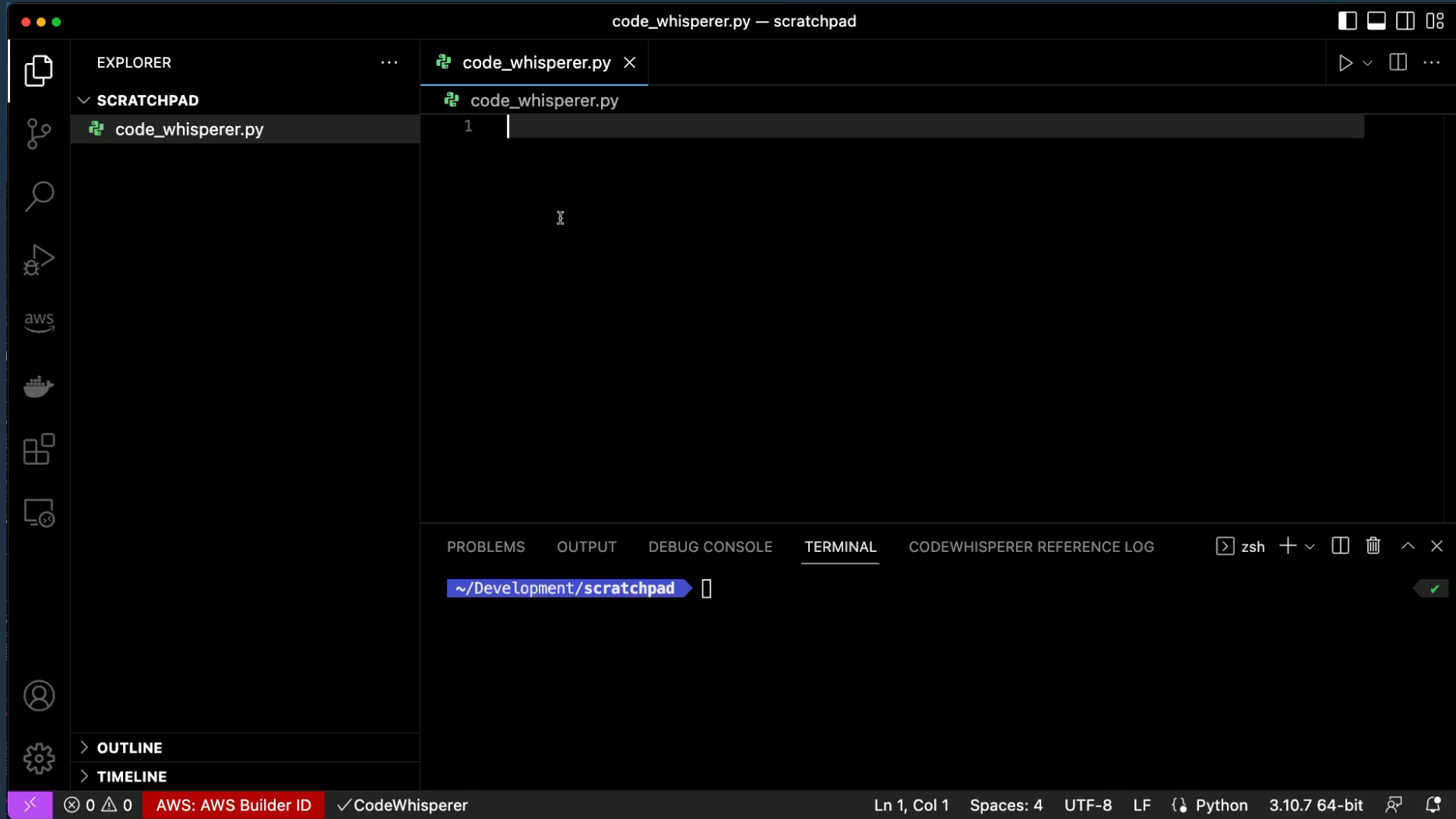
Other AI tools for developers

Amazon Rekognition

OBJECT, SCENE, AND ACTIVITY

CUSTOM LABELS

CONTENT MODERATION

TEXT

PPE DETECTION

FACE DETECTION AND ANALYSIS

FACE COMPARE & SEARCH

CELEBRITY RECOGNITION

VIDEO SEGMENTS

LIVE STREAM VIDEO

PATHING

Amazon Rekognition

Amazon Textract – Reading documents

Accuracy of forms and tables allows customers to reach **80–90% automation levels** on documents that previously needed manual processing.

INPUT ─────────────────────────────→ **OUTPUT**

Employment Application

Application Information

Full Name: Jane Doe

Phone Number: 555-0100

Home Address: 123 Any Street, Any Town, USA

Mailing Address: same as above

How did you hear about this position?
☒ Job fair ☐ Website ☐ Company Employee

Previous Employment History

Start Date	End Date	Employer Name	Position Held	Reason for leaving
1/15/2009	6/30/2011	Any Company	Assistant baker	relocated
7/1/2011	8/10/2013	Example Corp.	Baker	better opp.
8/15/2013	Present	AnyCompany	head baker	N/A, current

Raw Text

Employment Application	Application Information	Full Name: Jane Doe
Phone Number: 555-0100	Home Address: 123 Any street, Any Town. USA	

Forms

Job fair	Website
SELECTED	NOT_SELECTED

Table Recognition

7/1/2011	8/10/2013	Example Corp.	Baker	better opp.

Amazon Textract – Reading documents

Amazon Transcribe

Punctuation, capitalization

Speaker labelling/channel identification

Word-level time stamps

Word-level confidence scores

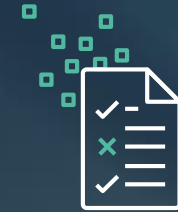Alternative transcriptions

Custom vocabulary

Vocabulary Filtering

Custom Language Models (CLM)

Language ID

PCI/PII content redaction

Amazon Transcribe

Amazon Translate

Broad language coverage
4970 X<>Y translation combinations
Language identification

Low latency
< 150ms/sentence on average
< 80ms/conversational/short form

Data security
Data ownership
Encryption
Access management

Broad regional coverage
Available in the following 17 regions

Customizable translation
Customize translation output with custom terminologies and active custom translation

Document batch translation
Translates large set of docx, pptx, xlsx, XML, HTML, and text documents with one API call

Broad domain coverage
Trained on 11 domains

Pay per use
Simple API calls and you pay for what you use

Amazon Comprehend

Documents
Email, chat, social, phone calls, and more

Amazon Comprehend
Automatically extract insights from text

Entities
+ Custom entities

Key Phrases

PII (Personally Identifiable Information)
Labeling + Detection

Sentiment + Targeted Sentiment

Document Classification

Topics

Language

Syntax

Events

Amazon Personalize

User personalization

Personalized ranking

Similar items

Amazon Lex

Intent
An action that a user wants performed

Prompt
Bot message designed to get data needed to complete the requested action

Fulfillment
Completed action based on the user request

● **Get account balance**

I'd like to check my balance

Sure, which account?

My savings account.

For verification purposes, What is your date of birth?

June 12, 1983

Thank you. Your savings account balance is $563.32.
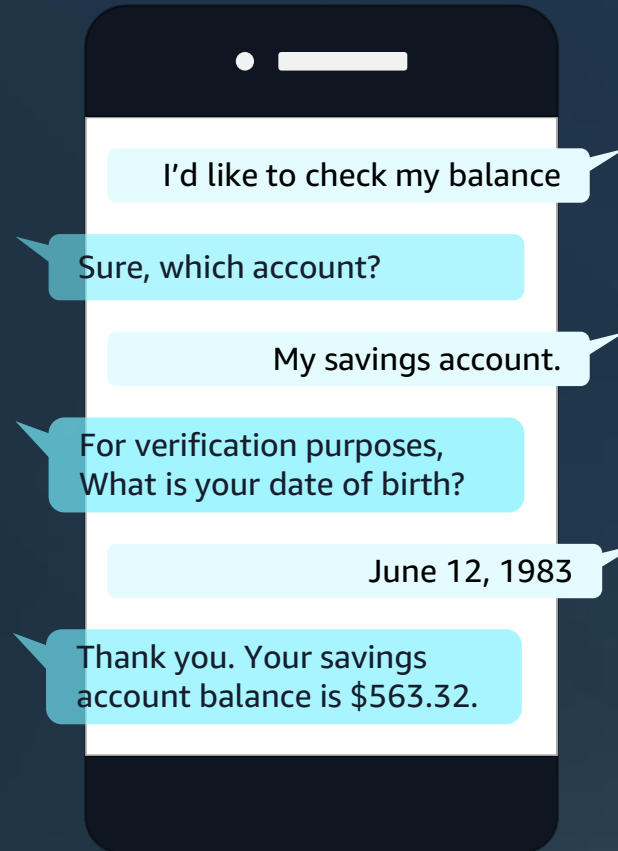
Utterance
User input that triggers an intent

Slot
Input data that is needed to complete the requested action

Getting started with AI guides

- AI guides:
    - Amazon CodeWhisperer: https://aws.amazon.com/codewhisperer/#How_to_get_started
    - Amazon Rekognition: https://docs.aws.amazon.com/rekognition/latest/dg/getting-started.html
    - Amazon Textract: https://docs.aws.amazon.com/textract/latest/dg/getting-started.html
    - Amazon Transcribe: https://docs.aws.amazon.com/transcribe/latest/dg/getting-started-sdk.html
    - Amazon Comprehend: https://docs.aws.amazon.com/comprehend/latest/dg/using-api-sync.html
    - Amazon LEX: https://docs.aws.amazon.com/lex/latest/dg/getting-started.html
    - Amazon Personalize: https://docs.aws.amazon.com/personalize/latest/dg/getting-started-domain-python.html
    - AWS Amplify: https://docs.amplify.aws/start/

-
    AI workshops:
    - Amazon Rekognition: https://catalog.us-east-1.prod.workshops.aws/workshops/4a2a9a24-071d-4d96-b9be-0cc57b7db434/en-US
    - Amazon Textract: https://catalog.us-east-1.prod.workshops.aws/workshops/f76c7a73-2080-4670-bd1d-db26a6259142/en-US
    - Amazon Personalize and AWS Amplify: https://catalog.us-east-1.prod.workshops.aws/workshops/bb080ee8-4722-4290-ac6e-d4cde0a65142/en-US

AWS Amplify

BUILD

Configure AWS backends fast

Seamlessly connect frontends

CLI

Studio

Libraries

Feature categories

Authentication

Analytics

DataStore

PubSub

Storage

Predictions

API (GraphQL & REST)

Interactions

Functions

Notifications

Geo

Extensibility

*Powered by AWS services such as
AWS AppSync (GraphQL API) and Amazon Cognito
(Authentication)*

Building your own ML models

Amazon Sagemaker

Integrated Workbench
Capabilities designed specifically for ML, data preparation, experiment management, and workflows

Managed Infrastructure
Designed for ultra low latency and high throughput, automatic scaling, and distributed training

Managed Tooling
Purpose-built from the ground up to work together including auto ML, collaboration, debugger, profiler, bias analyzer, and explainability

Amazon Sagemaker

Label data

Collect and prepare data

Store features

Check for bias

Visualize in notebooks

Pick algorithm

Train models

Tune parameters

Deploy in production

Manage and monitor

CI/CD

MODEL MANAGEMENT FOR EDGE DEVICES

Getting started with machine learning

ML guide:
Amazon Sagemaker: https://docs.aws.amazon.com/sagemaker/latest/dg/gs.html

ML workshop:
Amazon Sagemaker Immersion Day: https://catalog.us-east-1.prod.workshops.aws/workshops/63069e26-921c-4ce1-9cc7-dd882ff62575/en-US

AWS Machine learning path: https://aws.amazon.com/training/learn-about/machine-learning/

In summary

Visit the Data & AI/ML resource hub

Dive deeper into these resources, get inspired and learn how you can use AI and machine learning to accelerate your business outcomes.

- 6 steps to machine learning success e-book

- 7 leading machine learning use cases e-book

- Machine learning at scale e-book

- Achieving transformative business results with machine learning e-book

- Tackling our world's hardest problems with machine learning e-book

- Accelerating machine learning innovation through security e-book

- … and more!

https://bityl.co/FqdC

Visit resource hub

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Access the AI & ML learning plan courses built by AWS experts on AWS Skill Builder

- Get started with digital self-paced, on-demand training and ramp-up guides to help you grow your technical skills

- Learn how to apply machine learning, artificial intelligence, and deep learning to unlock new insights and value in your role

- Take the steps today, towards validating your expertise with an AWS Certified Machine Learning – Specialty Certification

https://bit.ly/3FnxDH7

Learn your way explore.skillbuilder.aws »

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Thank you!