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Microsoft Azure Virtual Training Day: AI Fundamentals

Microsoft

Introduction to AI

Learning Objectives

You will learn the following concepts:

- Artificial Intelligence in Azure
  - What is Artificial Intelligence?
  - Common Artificial Intelligence Workloads
  - Artificial Intelligence in Microsoft Azure

- Responsible AI
  - Challenges and Risks with AI
  - Principles of Responsible AI

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Lesson 1: Artificial Intelligence in Azure

What is Artificial Intelligence?

Software that imitates human capabilities

- Making decisions based on data and past experience
- Recognizing abnormal events
- Interpreting visual input
- Understanding written and spoken language
- Engaging in dialogs and conversations

Common Artificial Intelligence Workloads

Machine Learning	Predictive models based on data and statistics – the foundation for AI
Anomaly Detection	Systems that detect unusual patterns or events, enabling pre-emptive action
Computer Vision	Applications that interpret visual input from cameras, images, or videos
Natural Language Processing	Applications that can interpret written or spoken language
Conversational AI	AI agents, (or *bots*), that can engage in dialogs with human users

Artificial Intelligence in Microsoft Azure

Scalable, reliable cloud platform for AI

- Data storage
- Compute
- Services

Azure Machine Learning	A platform for training, deploying, and managing machine learning models
Cognitive Services	A suite of services developers can use to build AI solutions
Azure Bot Service	A cloud-based platform for developing and managing bots

Lesson 2: Responsible AI

Challenges and Risks with AI

Challenge or Risk	Example
Bias can affect results	A loan-approval model discriminates by gender due to bias in the data with which it was trained
Errors may cause harm	An autonomous vehicle experiences a system failure and causes a collision
Data could be exposed	A medical diagnostic bot is trained using sensitive patient data, which is stored insecurely
Solutions may not work for everyone	A predictive app provides no audio output for visually impaired users
Users must trust a complex system	An AI-based financial tool makes investment recommendations - what are they based on?
Who's liable for AI-driven decisions?	An innocent person is convicted of a crime based on evidence from facial recognition – who's responsible?

Principles of Responsible AI

Fairness

Reliability & Safety

Privacy & Security

Inclusiveness

Transparency

Accountability

https://www.microsoft.com/ai/responsible-ai

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Responsible AI

Module Overview

We covered the following concepts:

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  - Artificial Intelligence in Microsoft Azure

- Responsible AI
  - Challenges and Risks with AI
  - Principles of Responsible AI

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Explore Further on Microsoft Learn

Get started with artificial intelligence on Azure
https://aka.ms/learn-artificial-intelligence

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Machine Learning

Learning Objectives

You will learn the following concepts:

- Introduction to machine learning
  - What is machine learning?
  - Regression
  - Classification
  - Clustering

- Azure Machine Learning
  - What is Azure Machine Learning?
  - Azure Machine Learning designer
  - Automated Machine Learning

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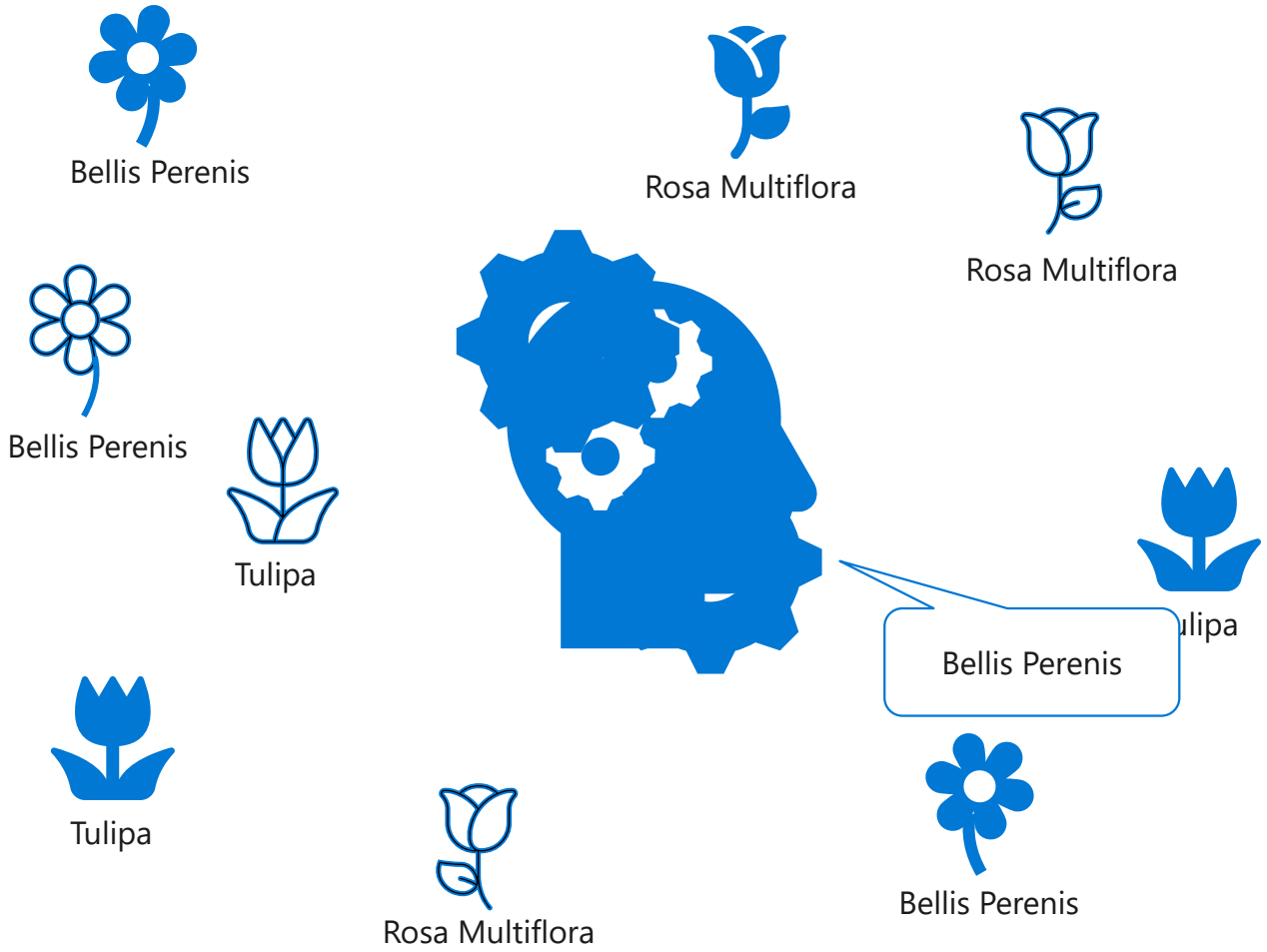
Lesson 1: Introduction to Machine Learning

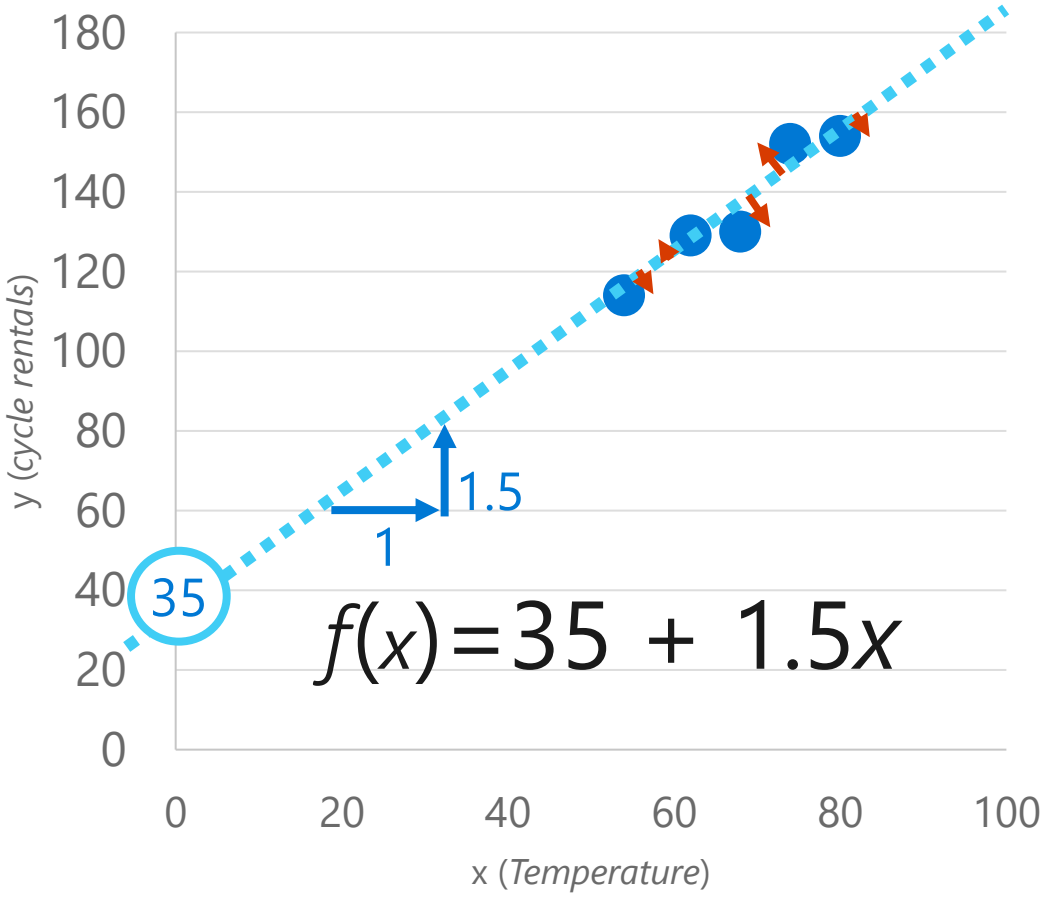
What is Machine Learning?

Creating predictive models by finding relationships in data



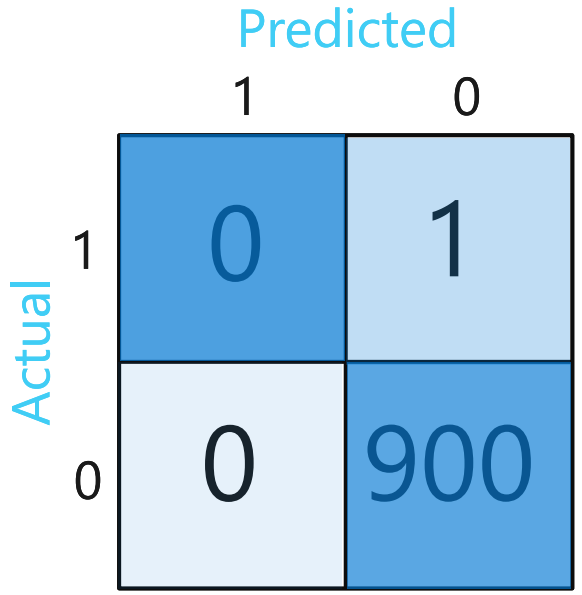
Regression

	x	y	f(x) ŷ
Training	56	115	
	61	126	
	67	137	
	72	140	
	76	152	
	82	156	
Validation	54	114	116
	62	129	128
	68	130	137
	74	152	146
	80	154	155



Classification

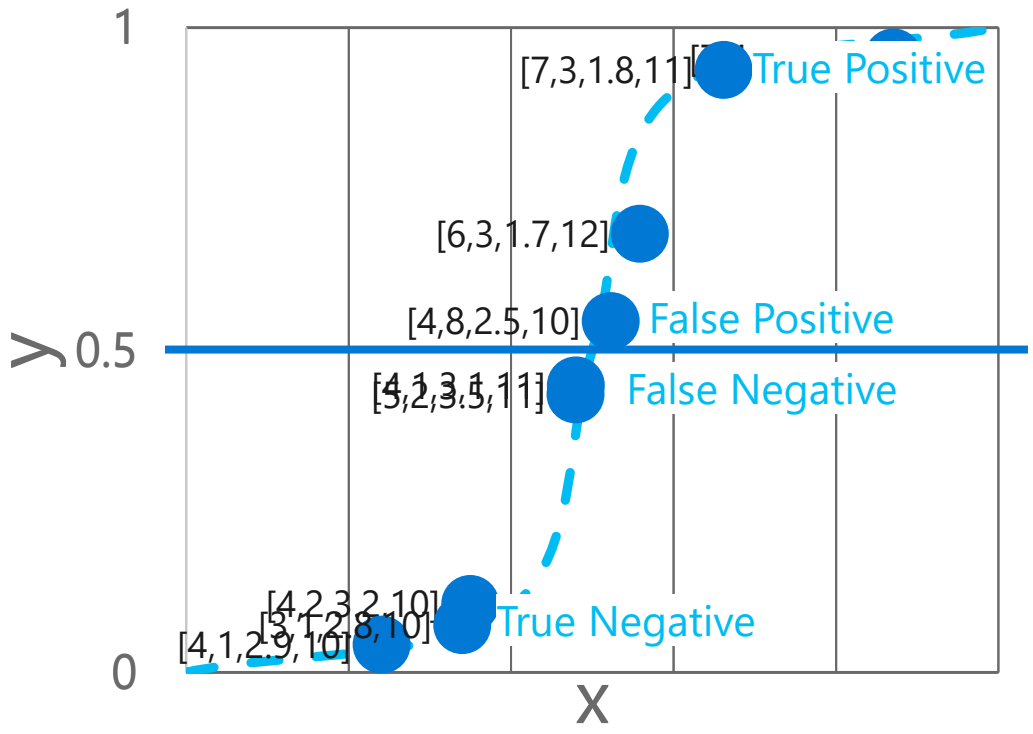
	x	y
Training	[4,2,3.2,10]	0
	[6,3,1.7,12]	1
	[5,2,3.5,11]	0
	[4,1,2.9,10]	0
	[7,4,2.1,11]	1
Validation	[3,1,2.8,10]	0
	[7,3,1.8,11]	1
	[4,8,2.5,10]	0
	[4,1,3,1,11]	1



P(1)	P(0)	ŷ	
0.2	0.8	0	✓
0.9	0.1	1	✓
0.6	0.4	1	✗
0.3	0.7	0	✗

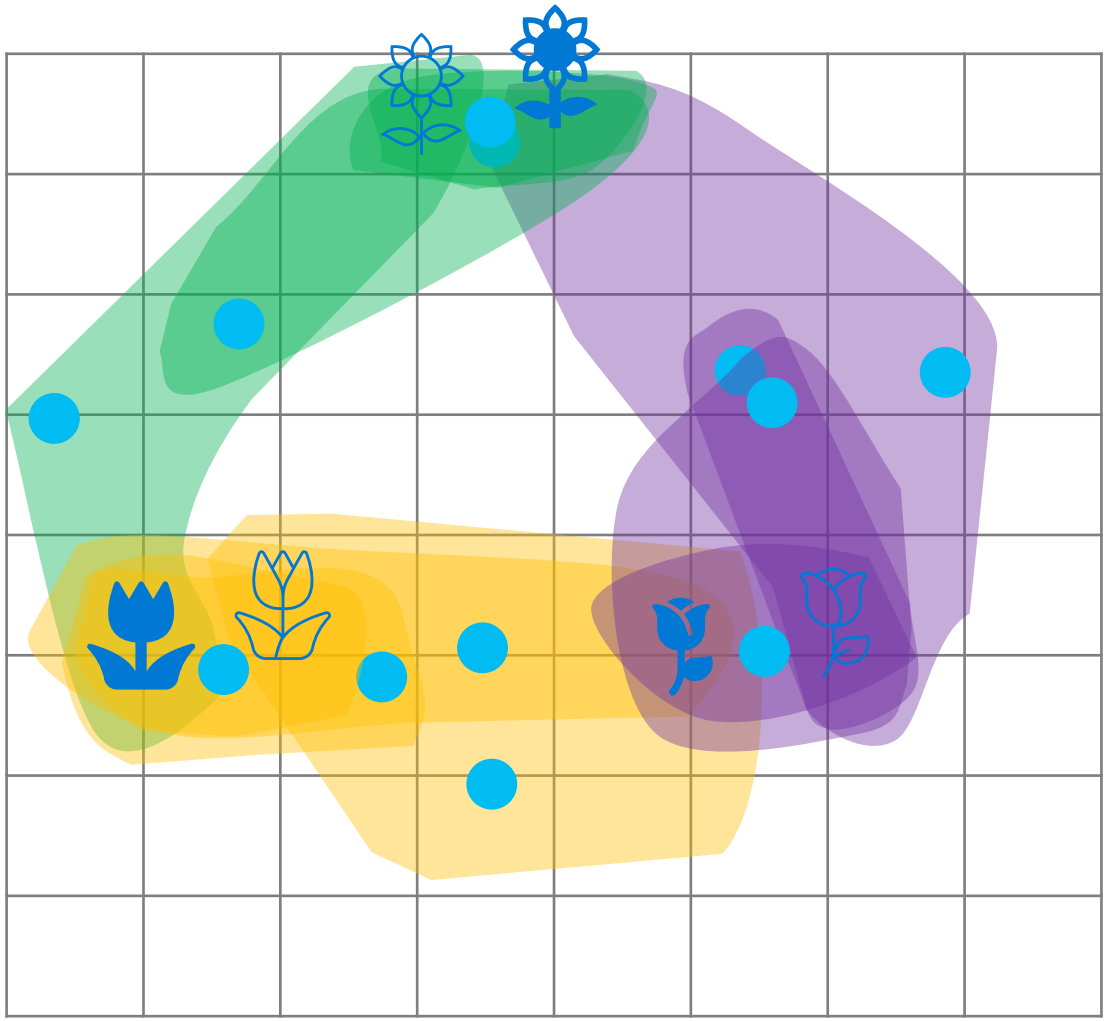
(126 +119) / (126 + 21 + 7 + 119)

(0 + 900) / (0 + 50 + 50 + 900)



Clustering

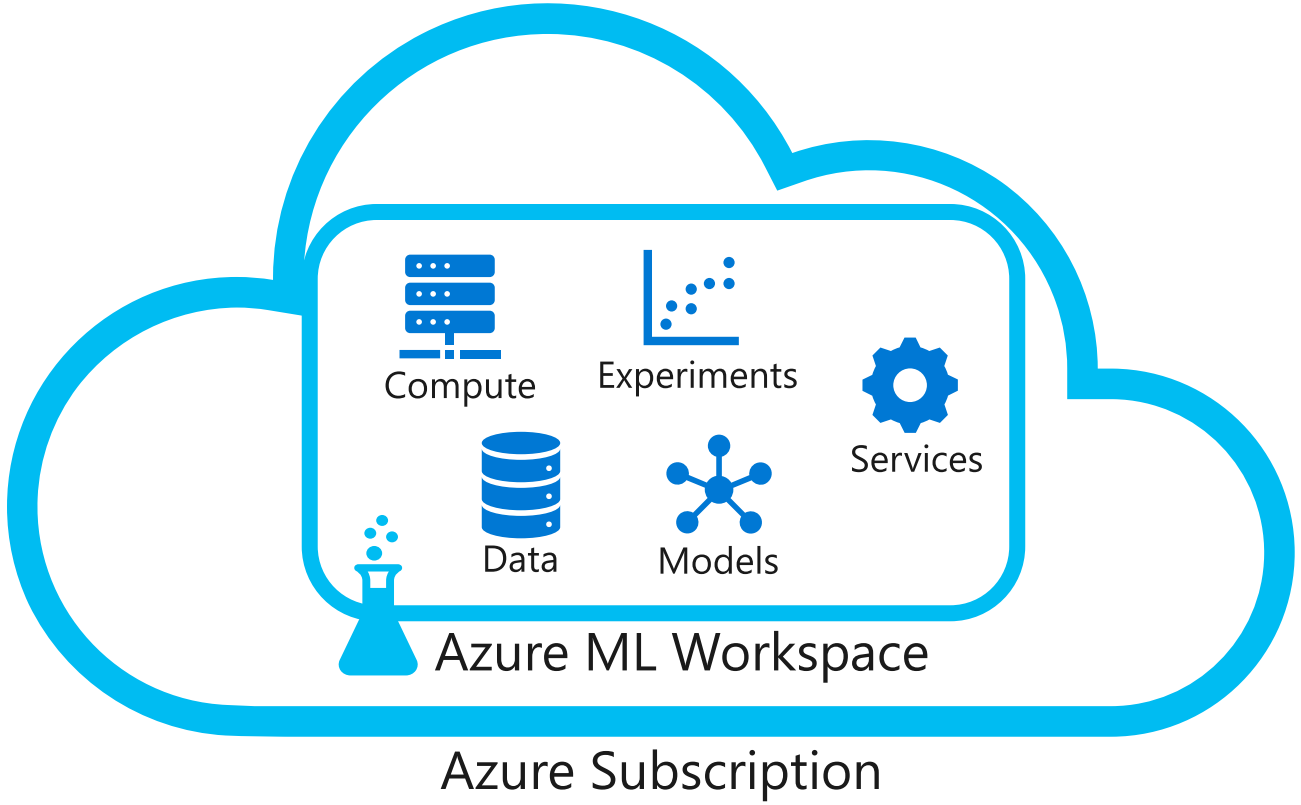
	6	3
	5	3
	2	3
	1	3
	3	8
	4	8



Lesson 2: Azure Machine Learning

What is Azure Machine Learning?

A cloud-based platform for machine learning



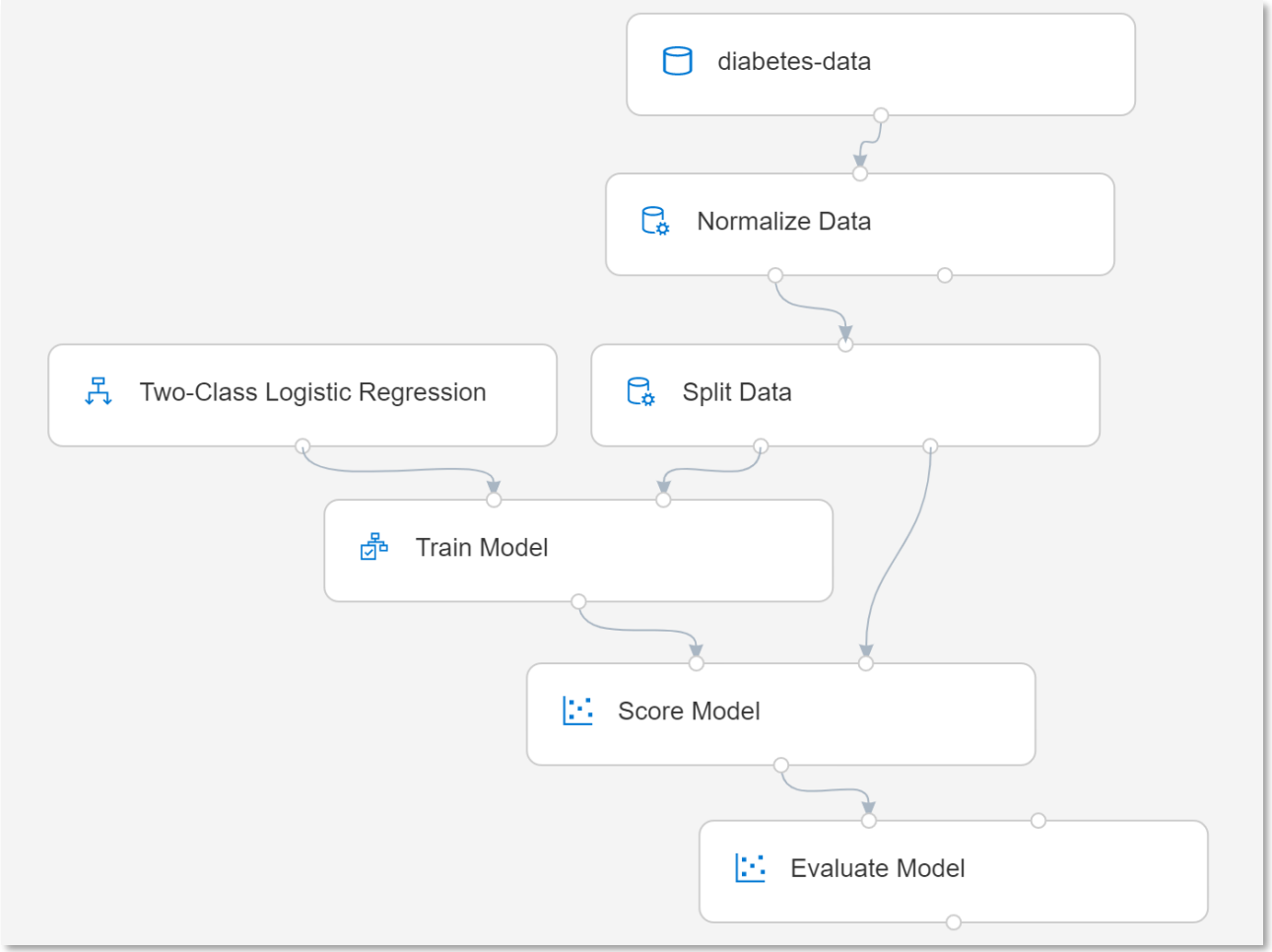
Automated Machine Learning

- Takes the hard work out of machine learning
  - Supply the data and desired model type, and let Azure Machine Learning find the best model

Azure Machine Learning *designer*

- Visual tool for creating a machine learning *pipeline*

1. Use a *training pipeline* to train and evaluate a model
2. Create an *inference pipeline* to predict labels from new data
3. Deploy the inference pipeline as a *service* for apps to use



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Azure Machine Learning

Module Overview

We covered the following concepts:

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- Azure Machine Learning
  - What is Azure Machine Learning?
  - Azure Machine Learning designer
  - Automated Machine Learning

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Explore Further on Microsoft Learn

Create no-code predictive models with Azure Machine Learning
https://aka.ms/no-code-ml

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Computer Vision

Learning Objectives

You will learn the following concepts:

- Computer Vision Concepts
  - What is Computer Vision?
  - Applications of Computer Vision

- Computer Vision in Azure
  - Cognitive Services
  - Image Analysis with the Computer Vision Service
  - Training Models with the Custom Vision Service
  - Analyzing Faces with the Face Service
  - Reading Text with the Computer Vision Service
  - Analyzing Forms with the Form Recognizer Service

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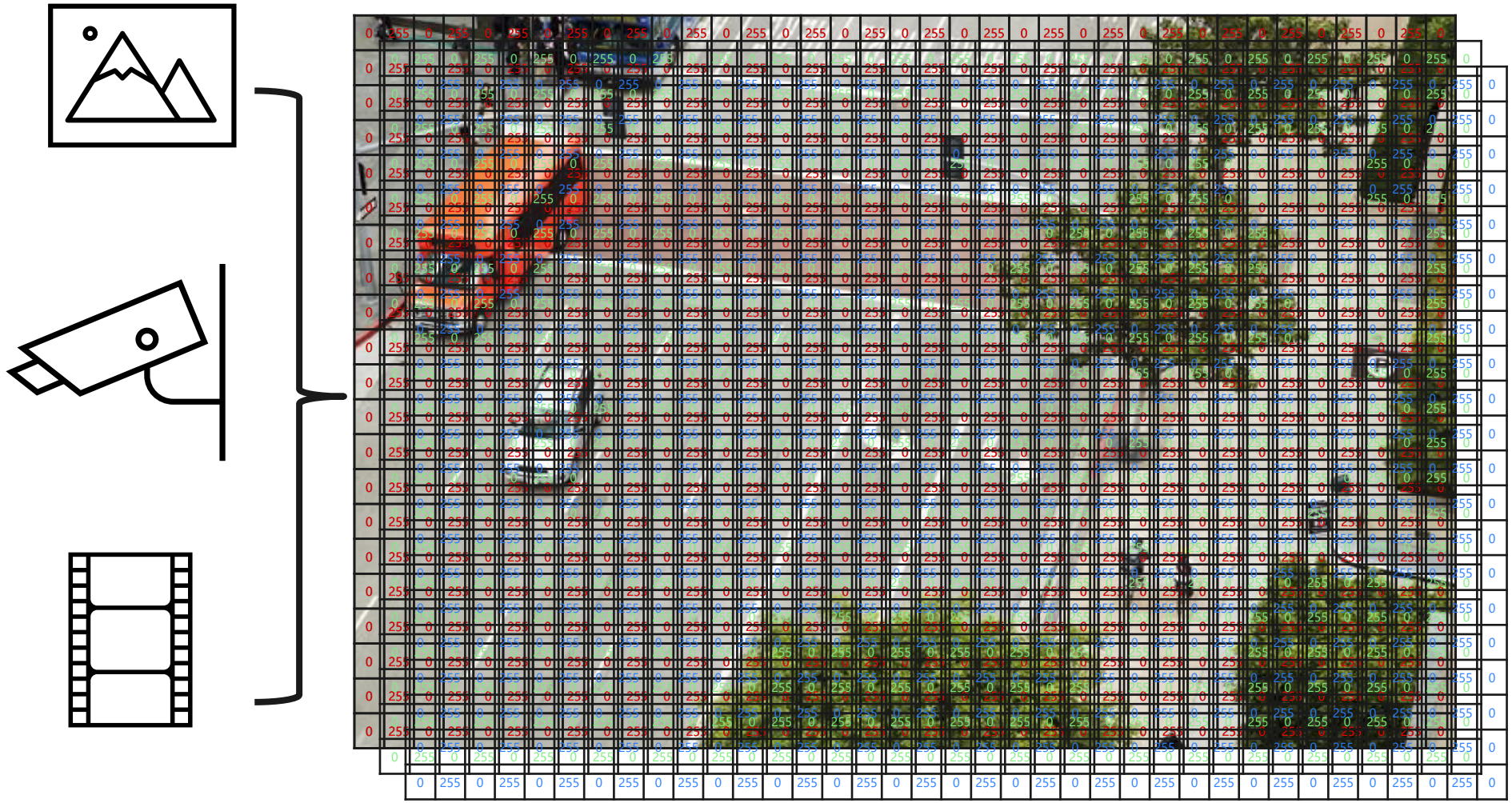
Lesson 1: Computer Vision Concepts

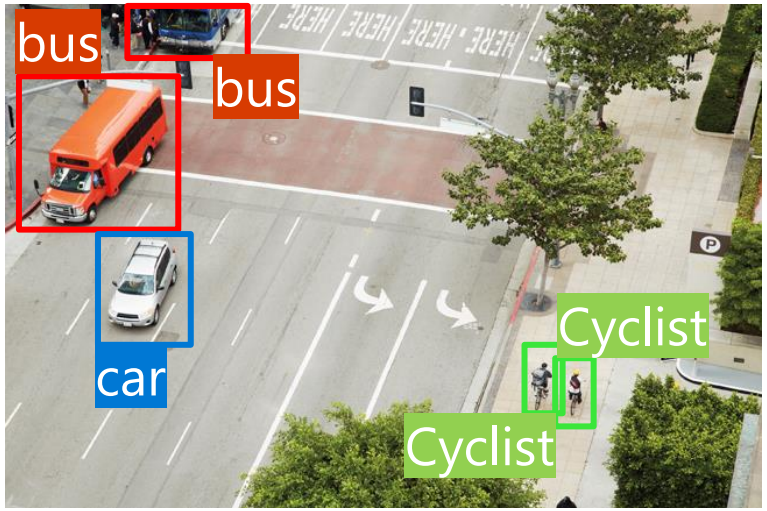
What is Computer Vision?



Applications of Computer Vision

Image Classification

Object Detection



Semantic Segmentation

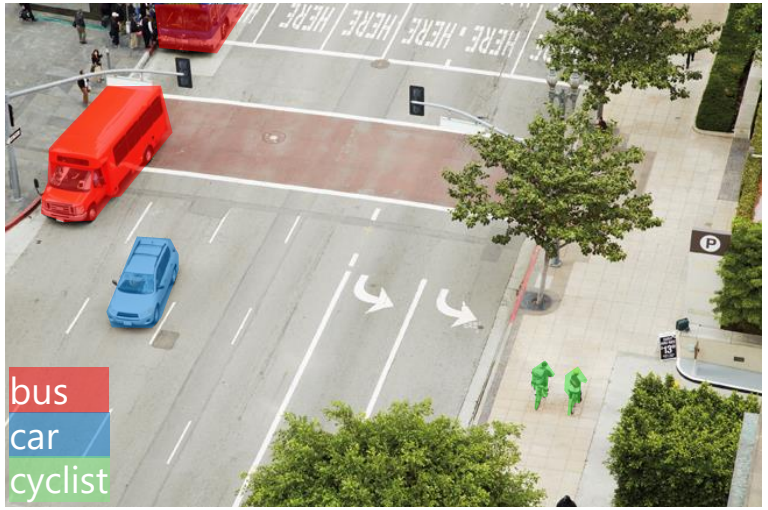


Image Analysis

Face Detection & Recognition

Optical Character Recognition

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Computer Vision

Lesson 2: Computer Vision in Azure

Cognitive Services

- AI application resources in an Azure subscription:
  - Standalone resources for specific services
  - General *Cognitive Services* resource for multiple services
- Consumed by applications via:
  - A REST endpoint (https:// address)
  - An authentication key
- You will explore cognitive services using an online environment named Visual Studio Codespaces

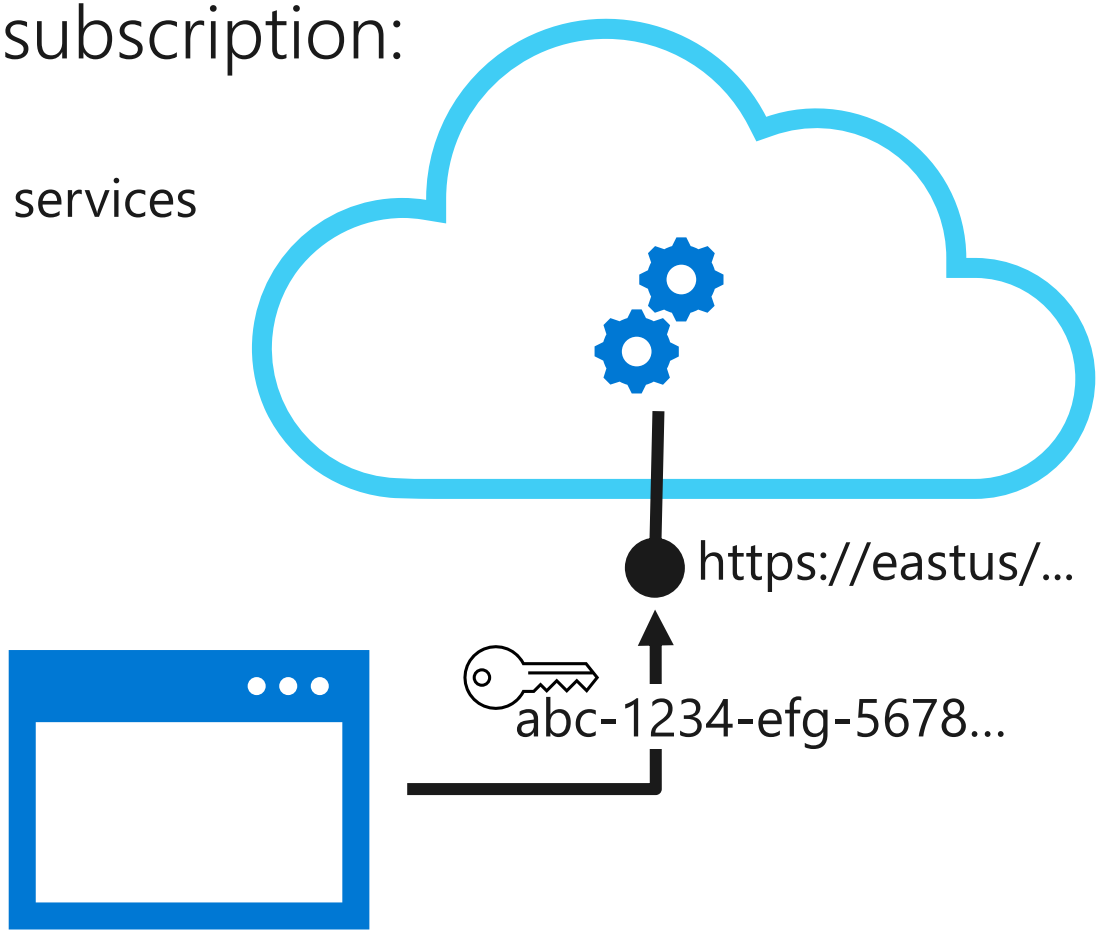
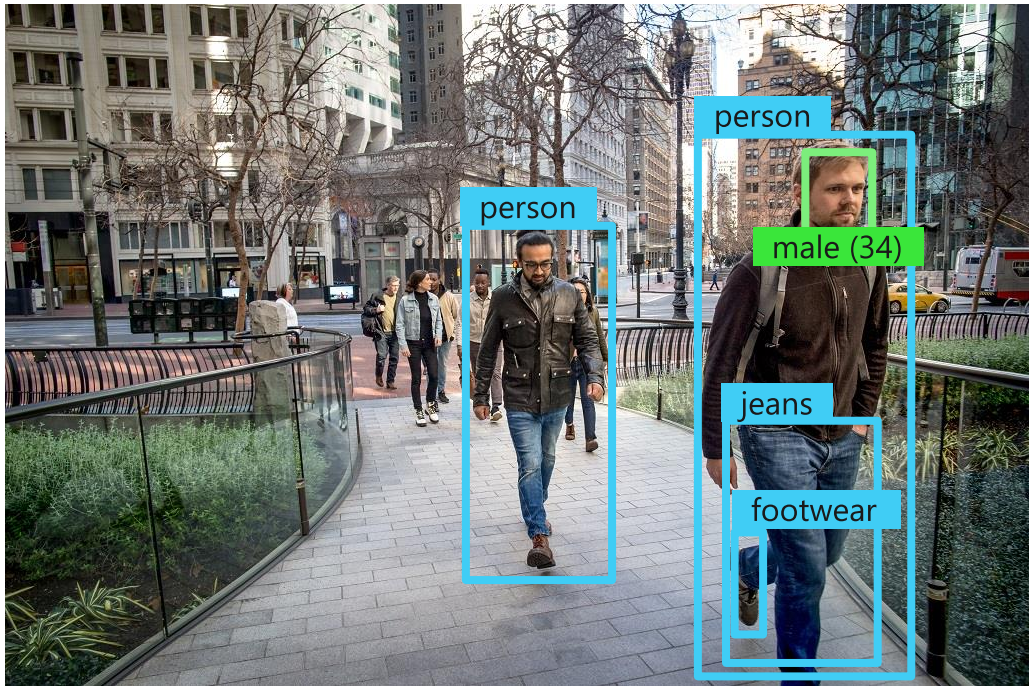


Image Analysis with the *Computer Vision* Service

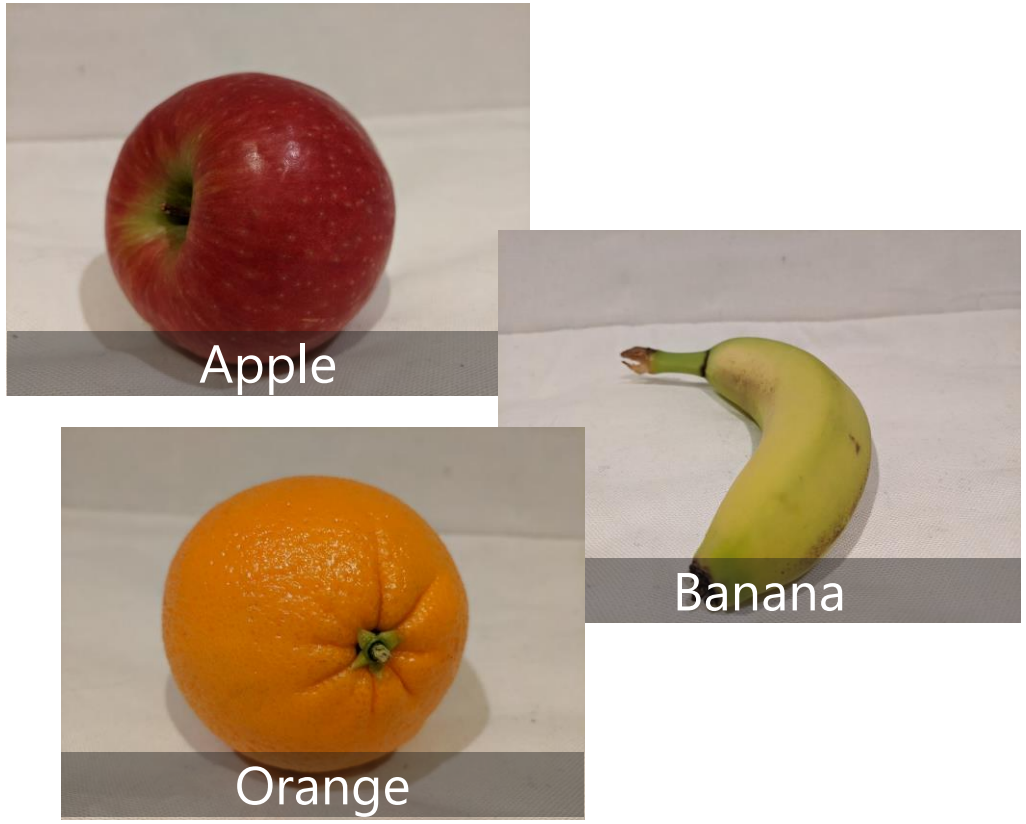
- Pre-trained computer vision model
- Object detection for over 10,000 predefined classes
- Image description and tag generation
- Face detection and analysis
- Content moderation
- Text detection and OCR



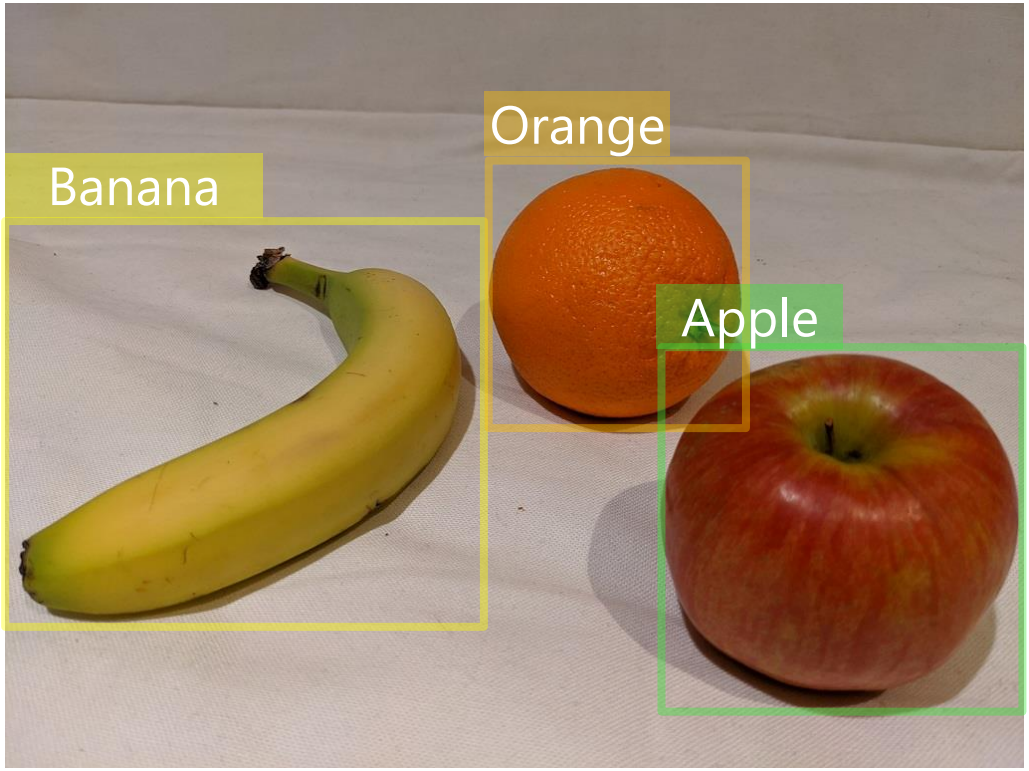
Caption: a group of people walking on a sidewalk
Tags: building, jeans, street, outdoor, jacket, city, person
Ratings: Adult: False, Racy: False, Gore: False

Training Models with the *Custom Vision* Service

Image Classification

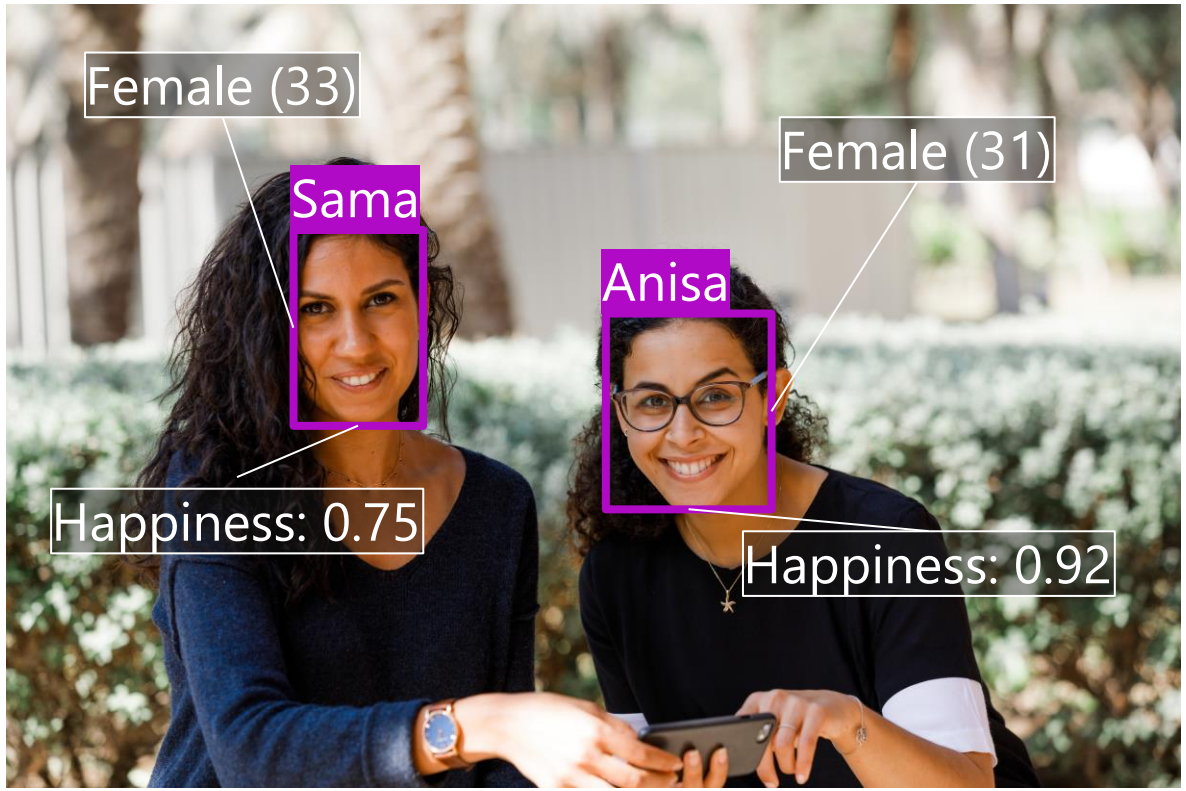


Object Detection



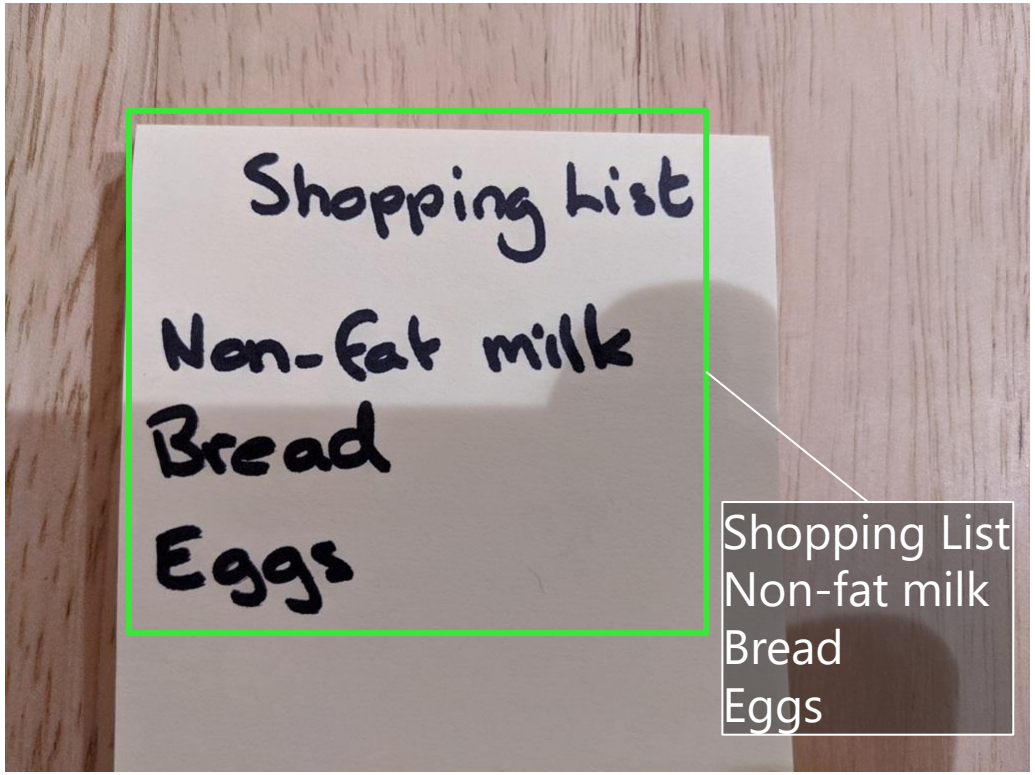
Analyzing Faces with the *Face* Service

- More facial analysis functionality than the *Computer Vision* service, including:
  - Facial attributes:
    - Gender
    - Age
    - Emotions
  - Facial recognition:
    - Similarity matching
    - Identity verification



Reading Text with the *Computer Vision* Service

- Detect the location of text:
  - Printed
  - Handwritten
- Options for quick text extraction from images, or asynchronous analysis of larger scanned documents



Analyzing Forms with the *Form Recognizer* Service

- Extract information from scanned forms in image or PDF format
  - Train a custom model using your own forms
  - Use the pre-trained receipt model
- Models perform semantic recognition of form fields – not just text extraction

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Image Classification

Module Overview

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Explore Further on Microsoft Learn

Explore computer vision in Microsoft Azure
https://aka.ms/explore-computer-vision

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Natural Language Processing

Learning Objectives

You will learn the following concepts:

- Introduction to Natural Language Processing
  - What is Natural Language Processing?
  - Natural Language Processing in Azure
- Using Natural Language Processing Services
  - Text Analytics
  - Speech Recognition and Synthesis
  - Translation
  - Language Understanding

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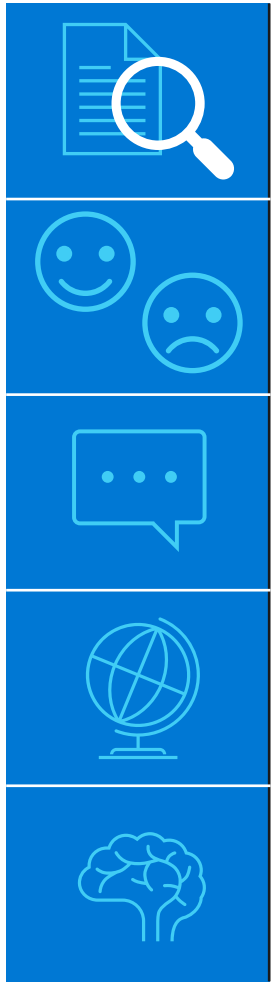
Lesson 1: Introduction to National Language Processing

What is Natural Language Processing?



Text analysis and entity recognition

Sentiment analysis

Speech recognition and synthesis

Machine translation

Semantic language modeling

Natural Language Processing in Azure

Cognitive Services

Text Analytics	• Language detection • Key phrase extraction • Entity detection • Sentiment analysis
Speech	• Text to speech • Speech to text • Speech translation
Translator Text	• Text translation
Language Understanding	• Custom language modeling

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Conversational AI

Learning Objectives

You will learn the following concepts:

- Conversational AI Concepts
  - What is Conversational AI?
  - Responsible AI Guidelines for Bots

- Conversational AI in Azure
  - QnA Maker Service
  - Azure Bot Service

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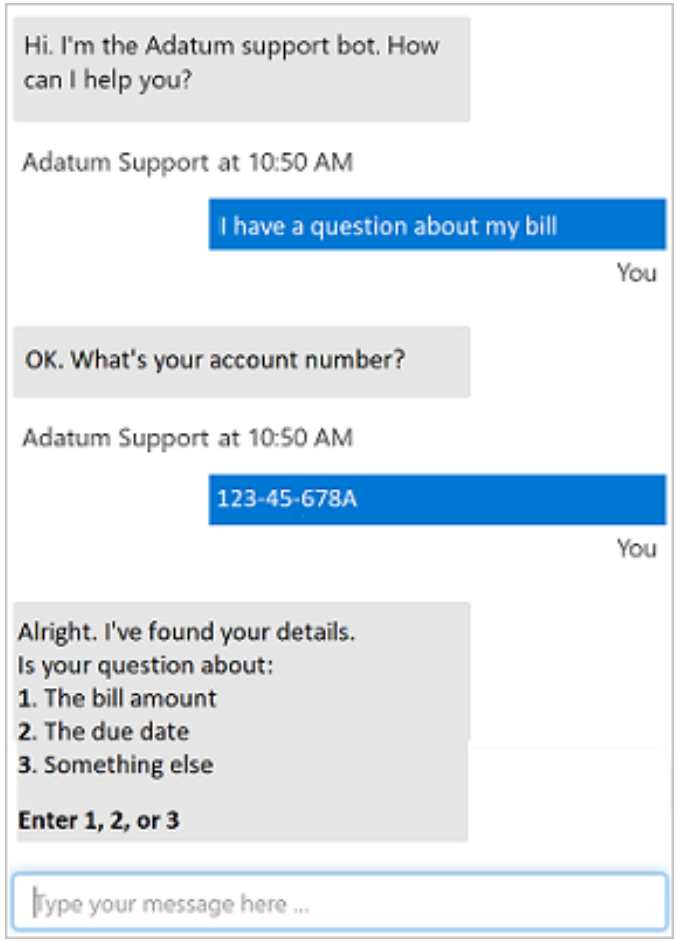
Lesson 1: Conversational AI Concepts

What is Conversational AI?

- A solution that enables a dialog between an AI agent and a human
- Generically, conversational AI agents are known as ***bots***
- Bots can engage over multiple *channels*:
  - Web chat interfaces
  - Email
  - Social media platforms
  - Voice



Responsible AI Guidelines for Bots

1. Be transparent about what the bot can (and can't) do
2. Make it clear that the user is communicating with a bot
3. Enable the bot to seamlessly hand-off to a human if necessary
4. Ensure the bot respects cultural norms
5. Ensure the bot is reliable
6. Respect user privacy
7. Handle data securely
8. Ensure the bot meets accessibility standards
9. Assume accountability for the bot's actions

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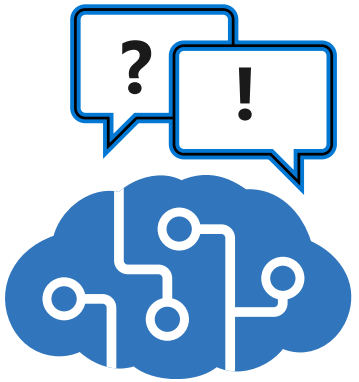
Using a Bot

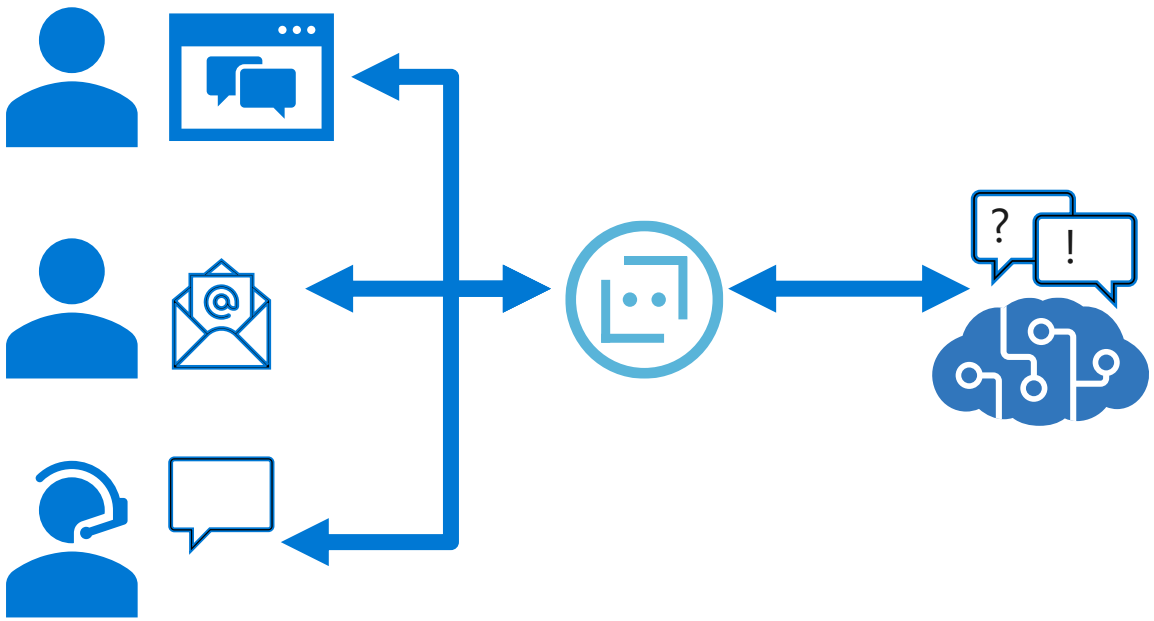
Lesson 2: Conversational AI in Azure

The QnA Maker Service

- Define a *knowledge base* of question and answer pairs:
  - By entering questions and answers
  - From an existing FAQ document
  - By using built-in *chit-chat*
- Consume the knowledge base from client apps, including bots



Azure Bot Service



- Cloud-based platform for developing and managing bots
- Integration with LUIS, QnA Maker, and others
- Connectivity through multiple channels

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Create a Bot

Module Overview

We covered the following concepts:

- Conversational AI Concepts
  - What is Conversational AI?
  - Responsible AI Guidelines for Bots

- Conversational AI in Azure
  - QnA Maker Service
  - Azure Bot Service

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References

Explore conversational AI in Microsoft Azure
https://aka.ms/explore-bots

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Natural Language Processing

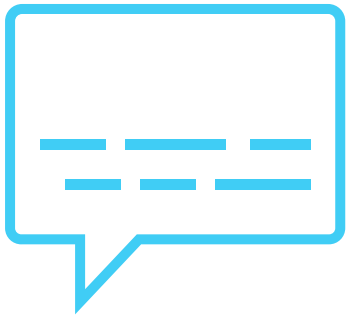
Lesson 2: Using Natural Language Processing Services

Text Analytics

I had a wonderful vacation in France.

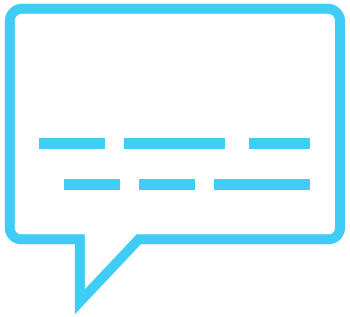
- Predominant Language: English
- Sentiment: 88% (positive)
- Key Phrases: "wonderful vacation"
- Entities: France

Speech Recognition and Synthesis

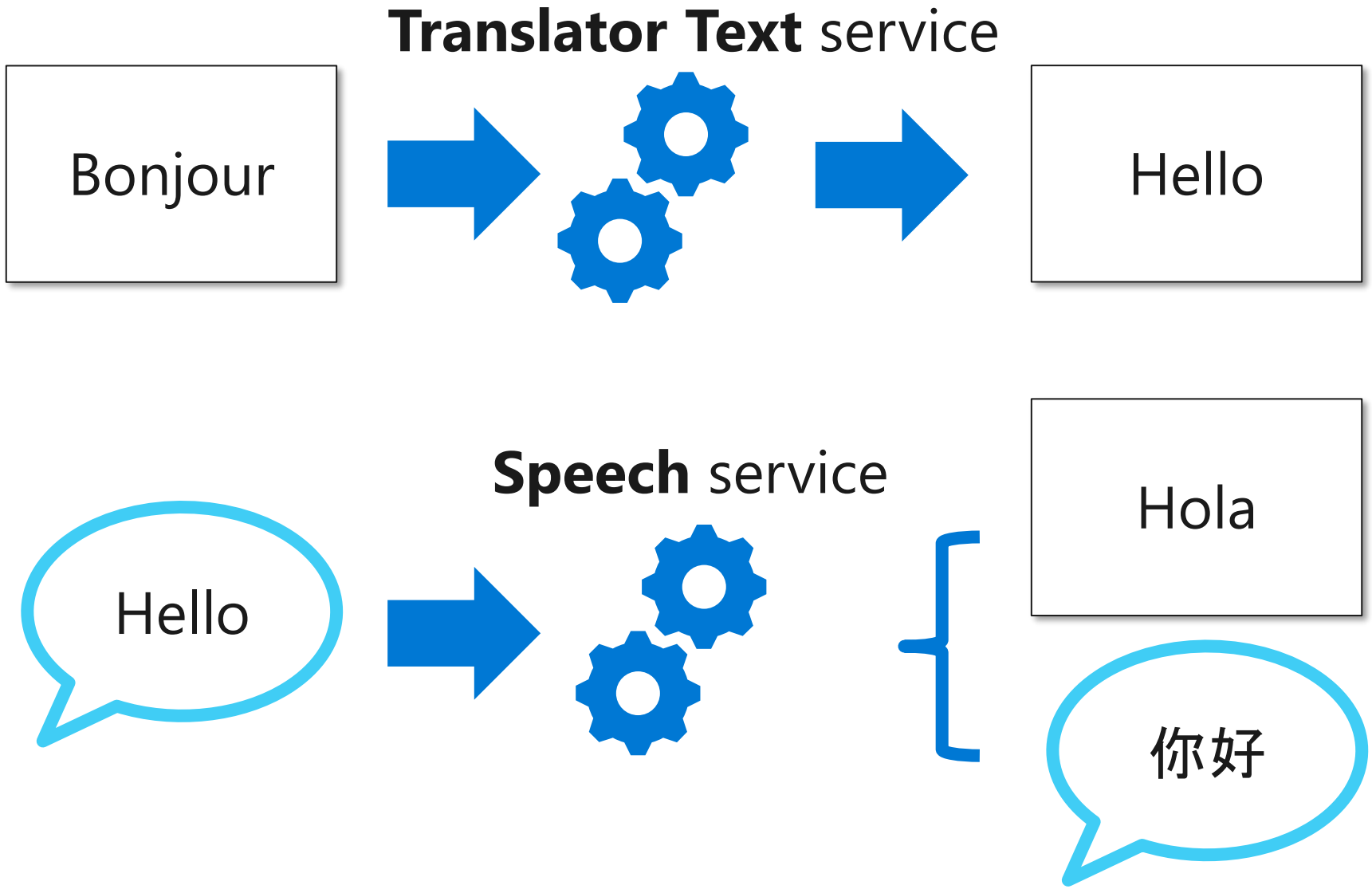


Use the *speech-to-text* capabilities of the **Speech** service to transcribe audible speech to text

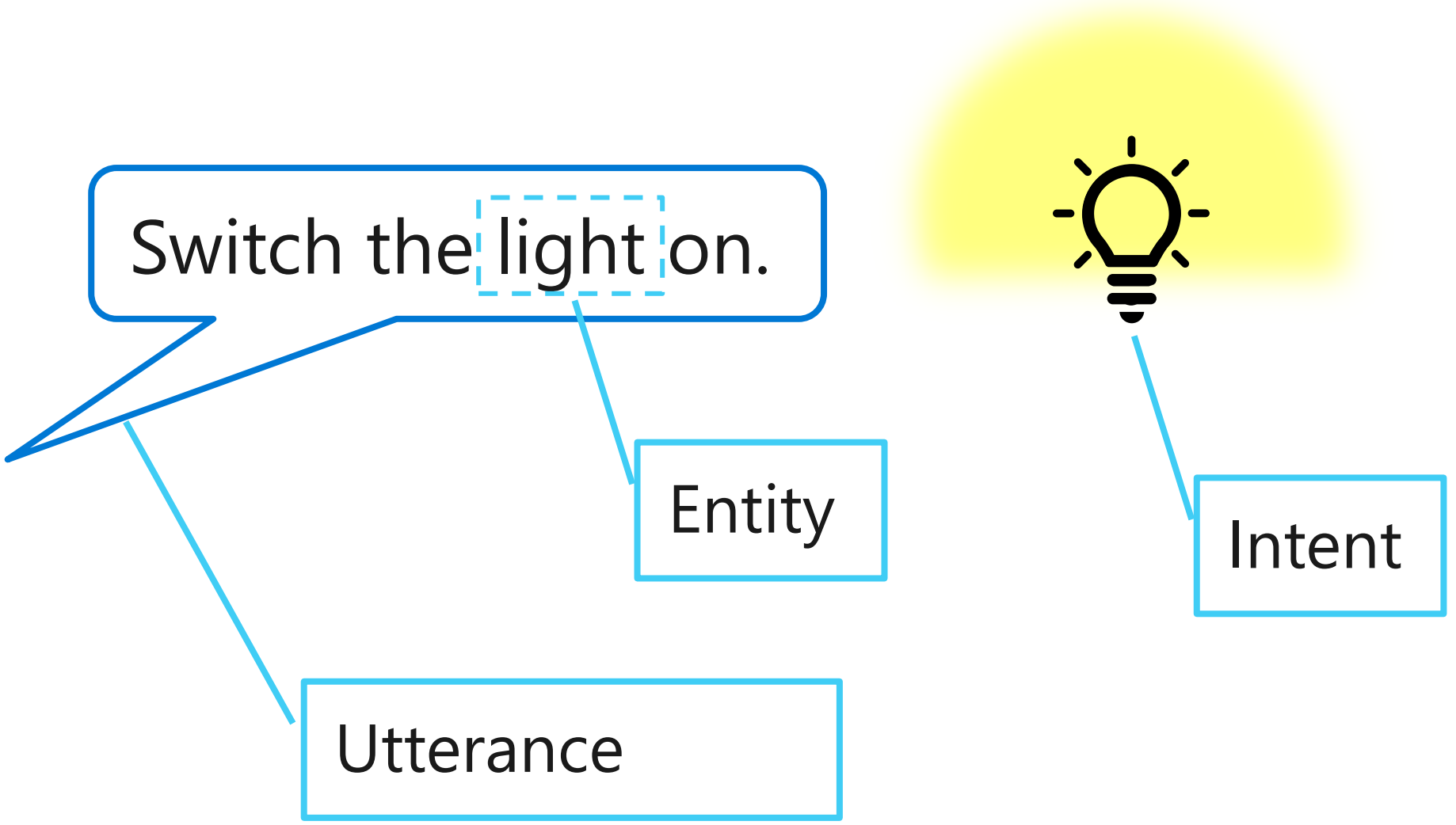
Use the *text-to-speech* capabilities of the **Speech** service to generate audible speech from text



Translation



Language Understanding



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Language Understanding

Module Overview

We covered the following concepts:

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