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

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

Responsible AI

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Explore Further on Microsoft Learn

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

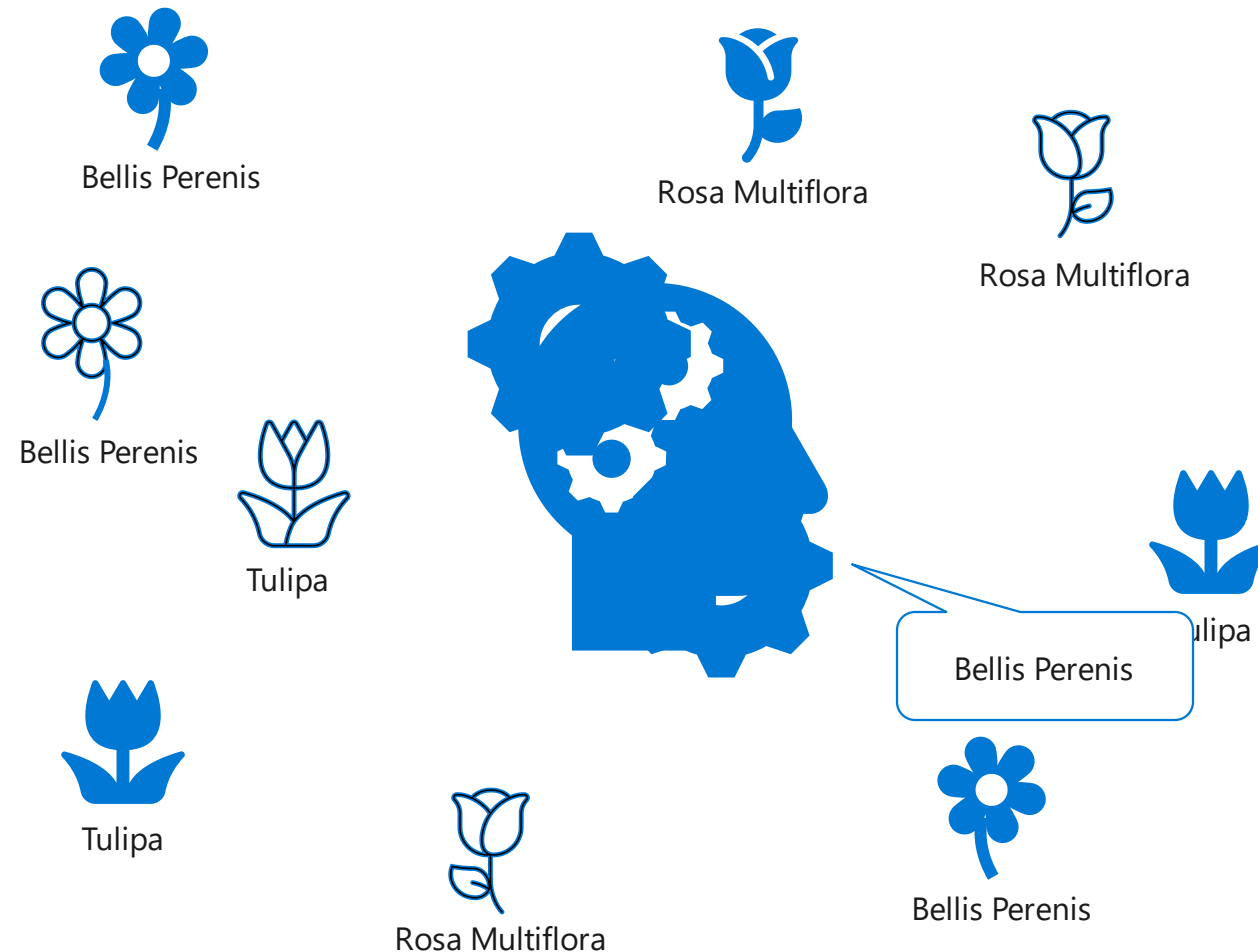# Learning Objectives

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
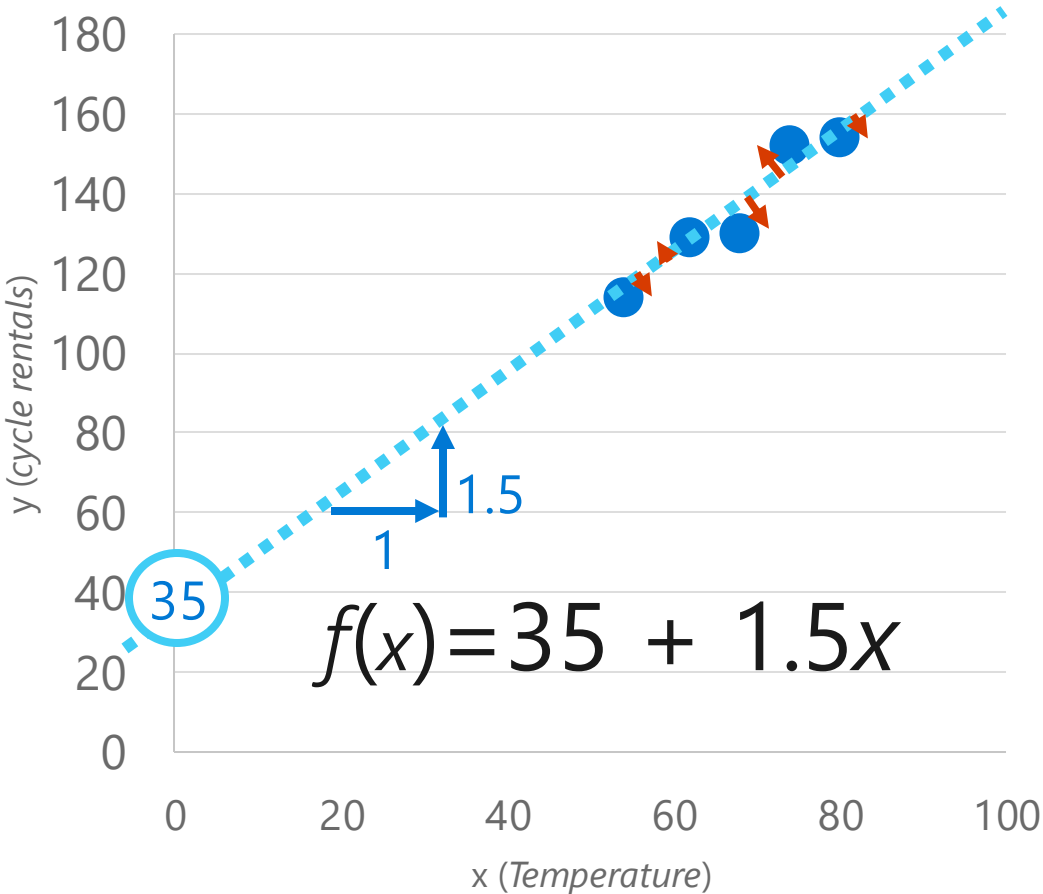
Lesson 1: Introduction to Machine Learning

What is Machine Learning?

Creating predictive models by finding relationships in data

Regression

x	y
56	115
61	126
67	137
72	140
76	152
82	156
54	114
62	129
68	130
74	152
80	154

Training / Validation

$f(x)$ $\hat{y}$
116
128
137
146
155

$$f(x) = 35 + 1.5x$$

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

Predicted

		1	0
Actual	1	0	1
	0	0	900

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)

y

1

0.5

0

[7,3,1.8,11] True Positive

[6,3,1.7,12]

[4,8,2.5,10] False Positive

[4,1,3.1,11] False Negative
[5,2,3.5,11]

[4,2,3.2,10]
[3,1,2.8,10] True Negative
[4,1,2.9,10]

x

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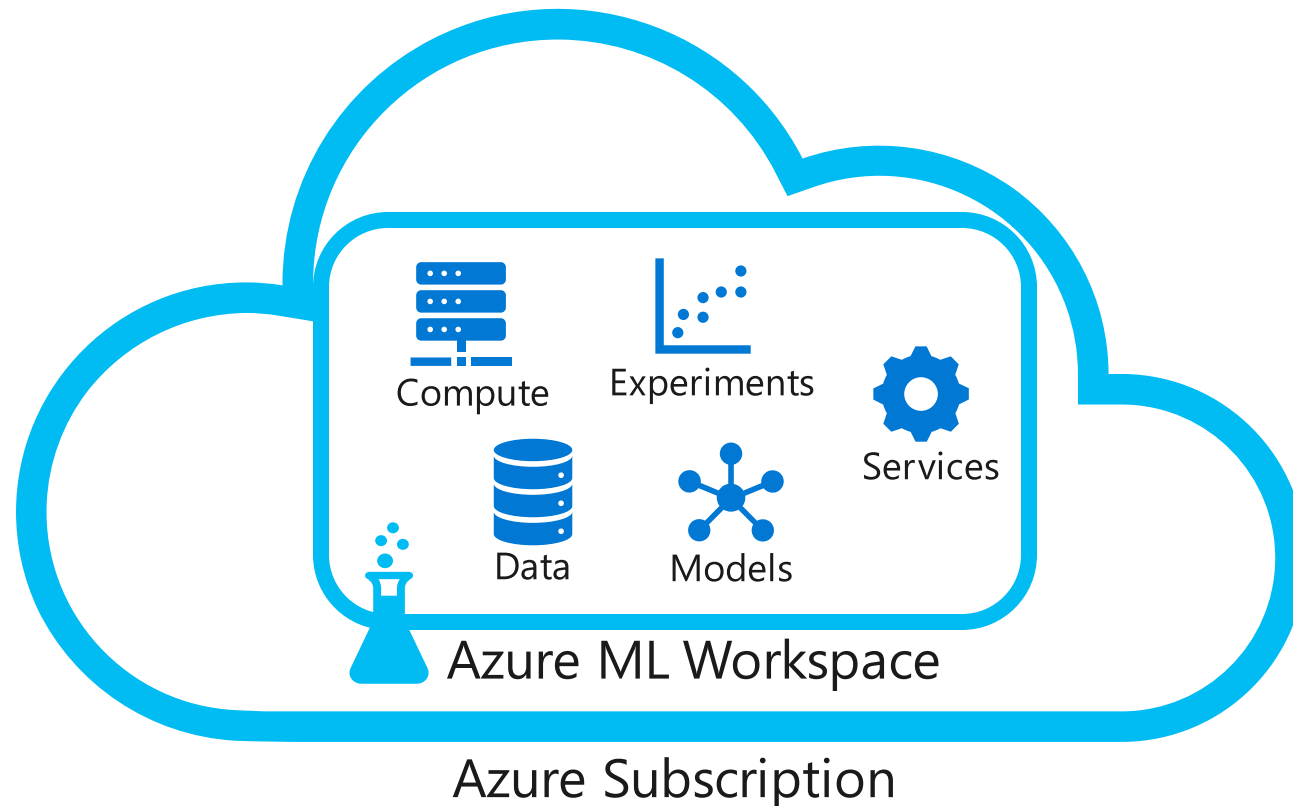
- Takes the hard work out of machine learning
  - Supply the data and desired model type, and let Azure Machine Learning find the best model

Data → 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
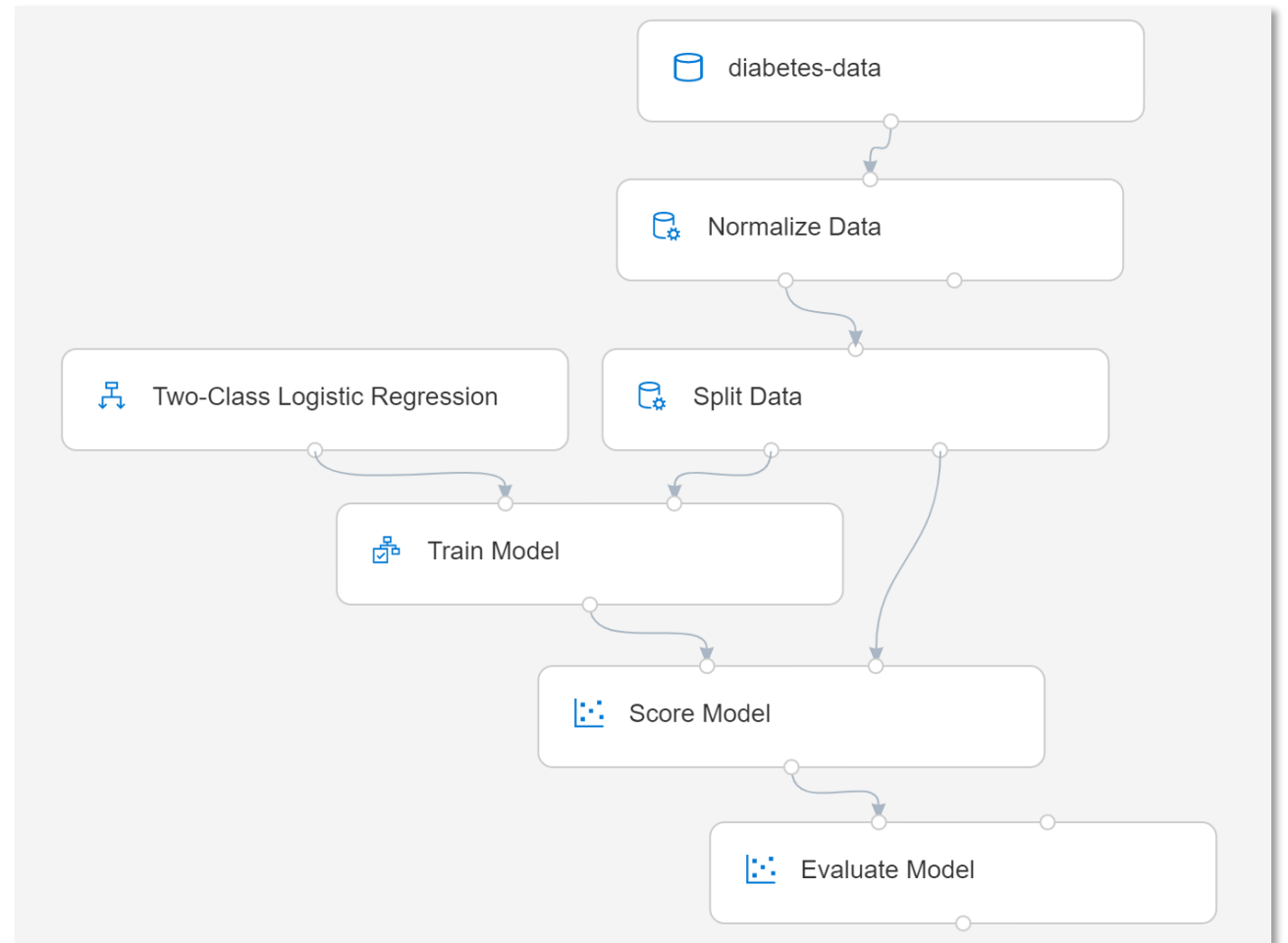
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Azure Machine Learning

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Explore Further on Microsoft Learn

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

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

Lesson 1: Computer Vision Concepts
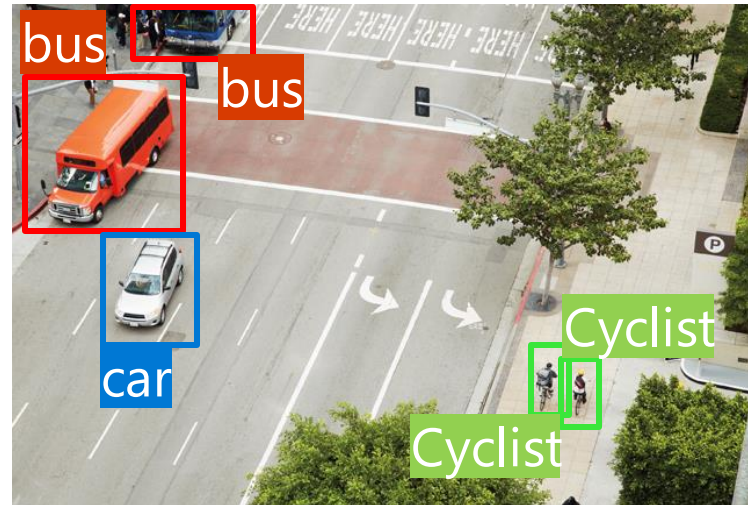
What is Computer Vision?

Applications of Computer Vision

Image Classification
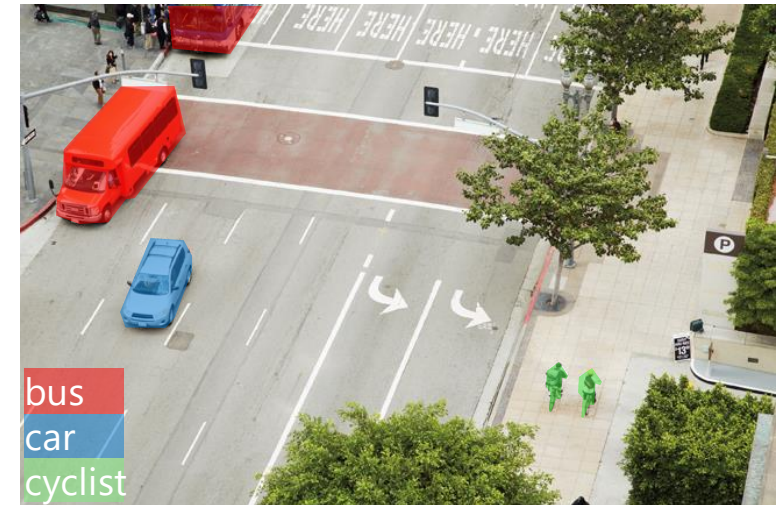

Taxi

Object Detection

bus
bus
car
Cyclist
Cyclist

Semantic Segmentation

bus
car
cyclist

Image Analysis

A person with a dog on a street

Face Detection & Recognition

Optical Character Recognition

The Toronto Dominion Bank

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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

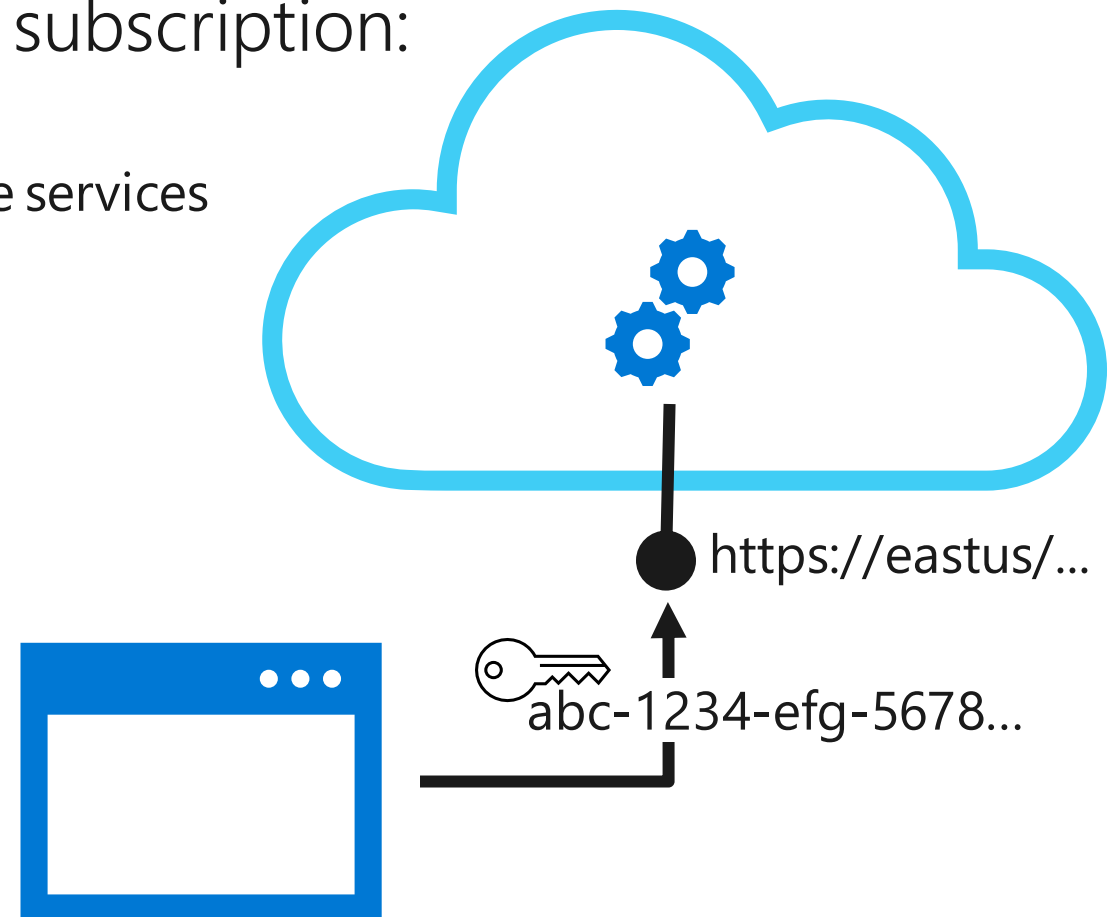- You will explore cognitive services using an online environment named Visual Studio Codespaces

https://eastus/...

abc-1234-efg-5678...

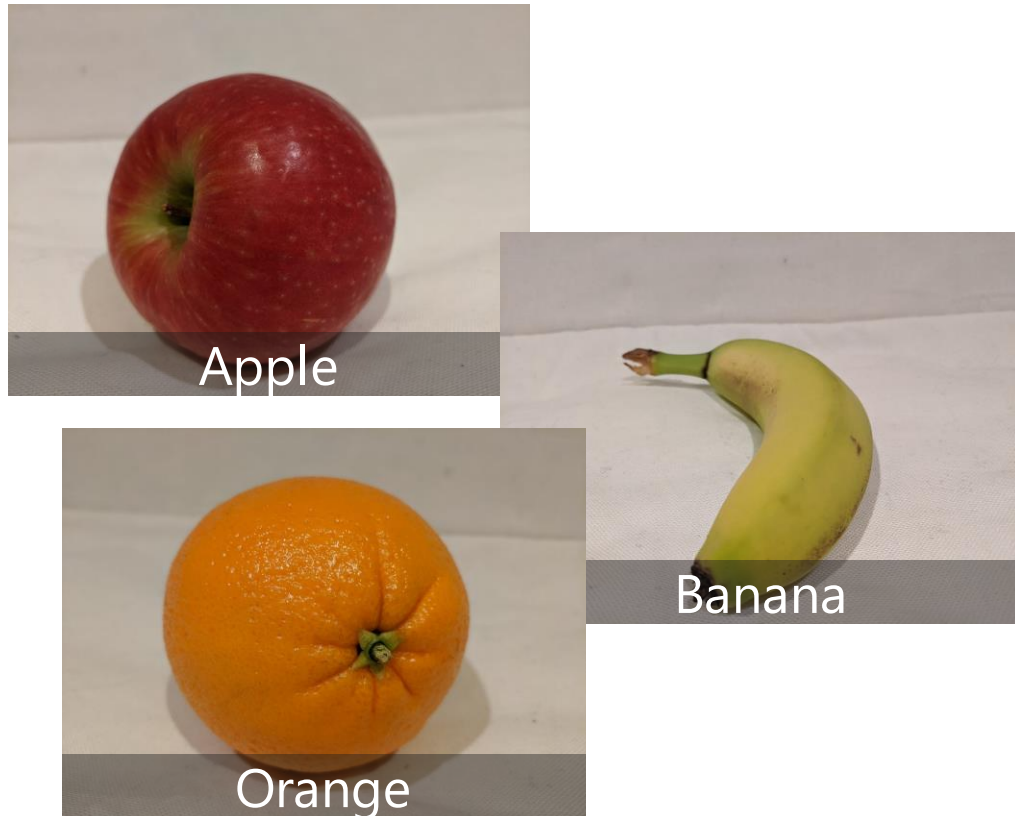# Image Analysis with the *Computer Vision* Service

- Pre-trained computer vision model
- Object detection for over 10,000 predefined classes
- Image description and tag generation
- Face detection and analysis
- Content moderation
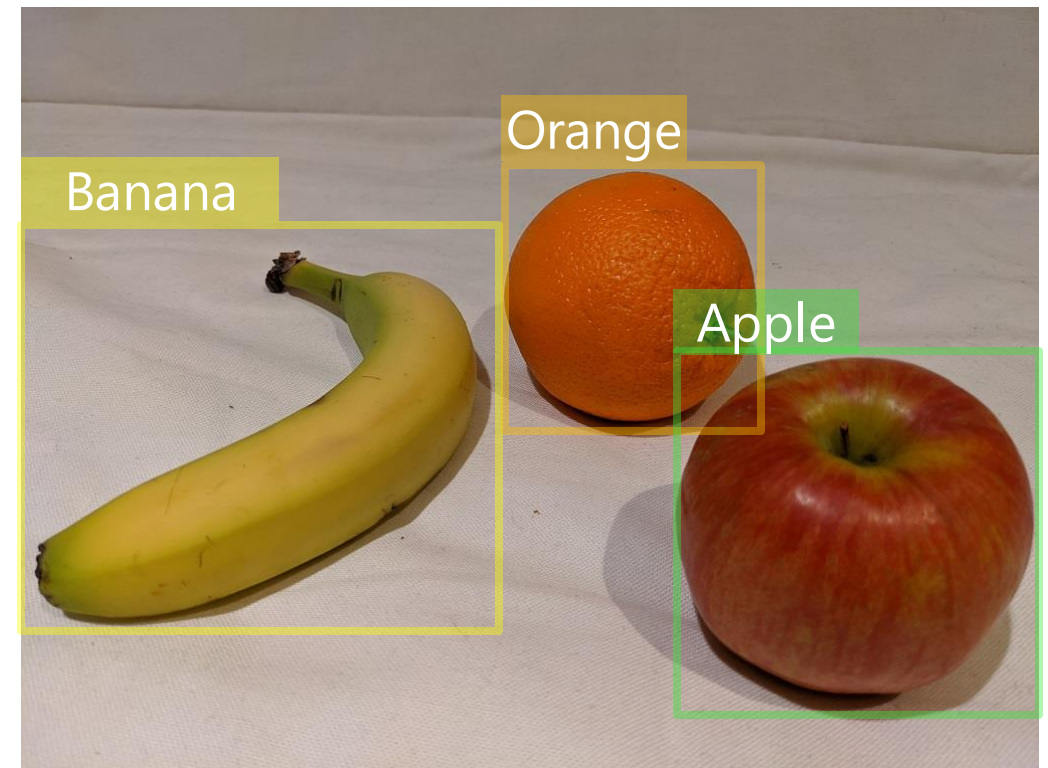- Text detection and OCR
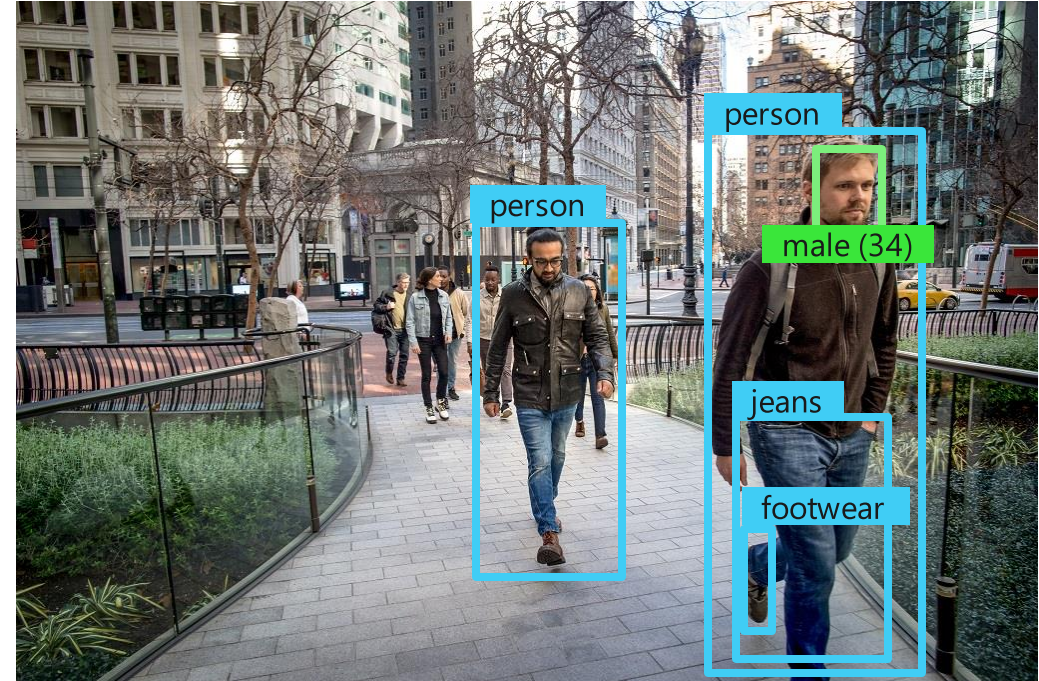
Caption: a group of people walking on a sidewalk
Tags: building, jeans, street, outdoor, jacket, city, person
Ratings: Adult: False, Racy: False, Gore: False

Training Models with the *Custom Vision* Service
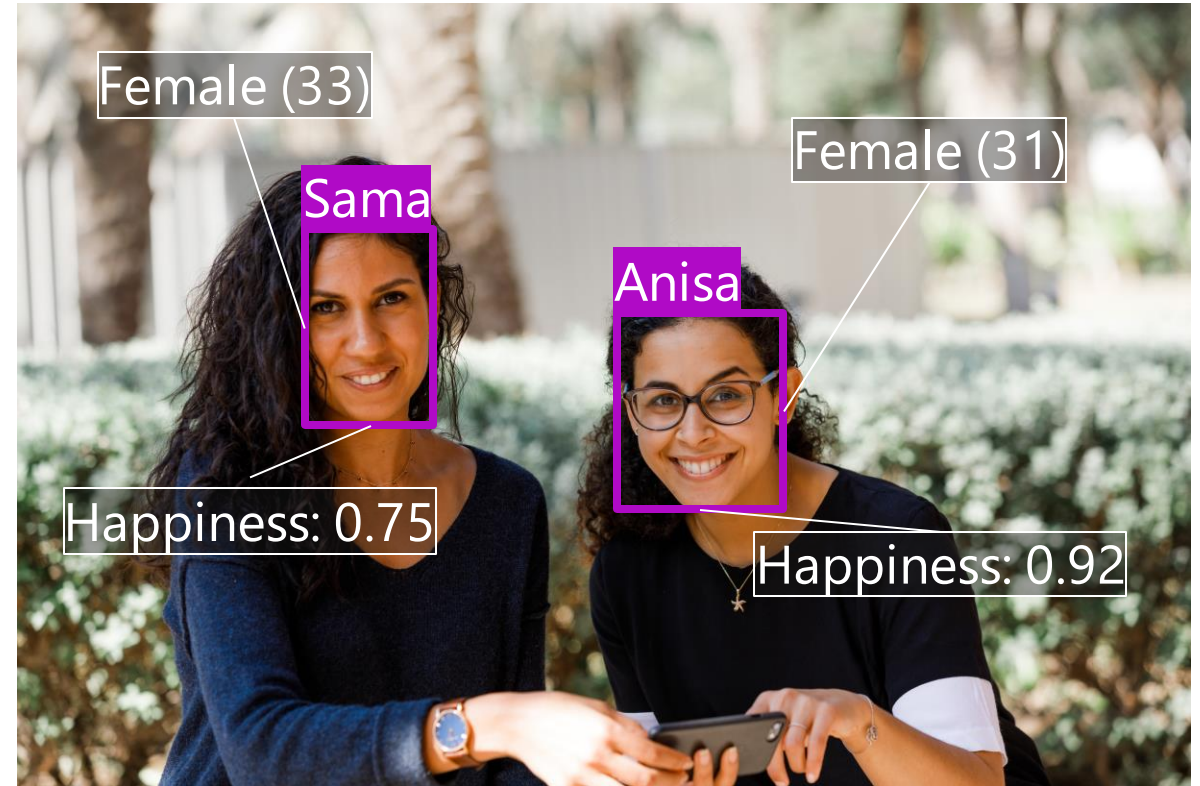
## Image Classification

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
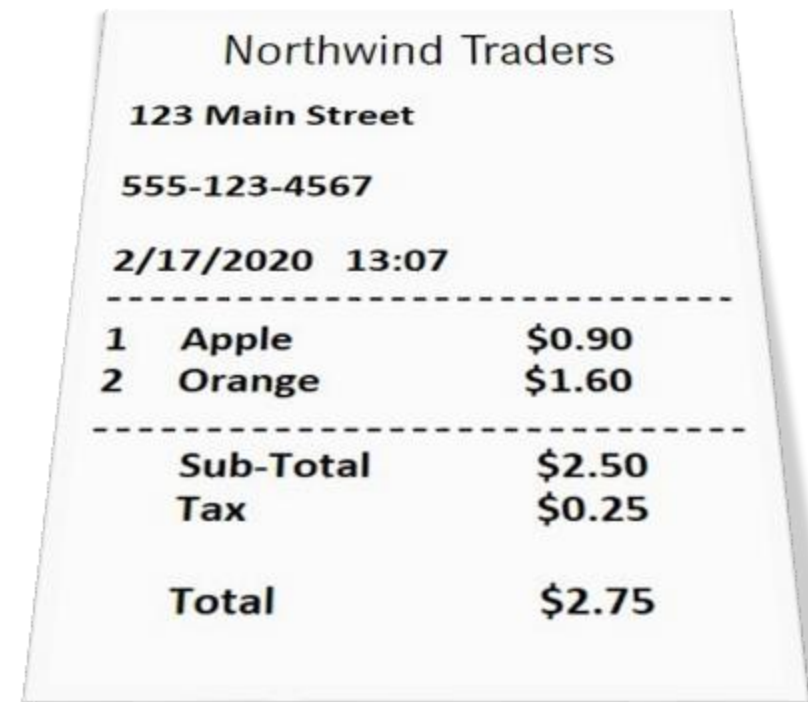   - Identity verification

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
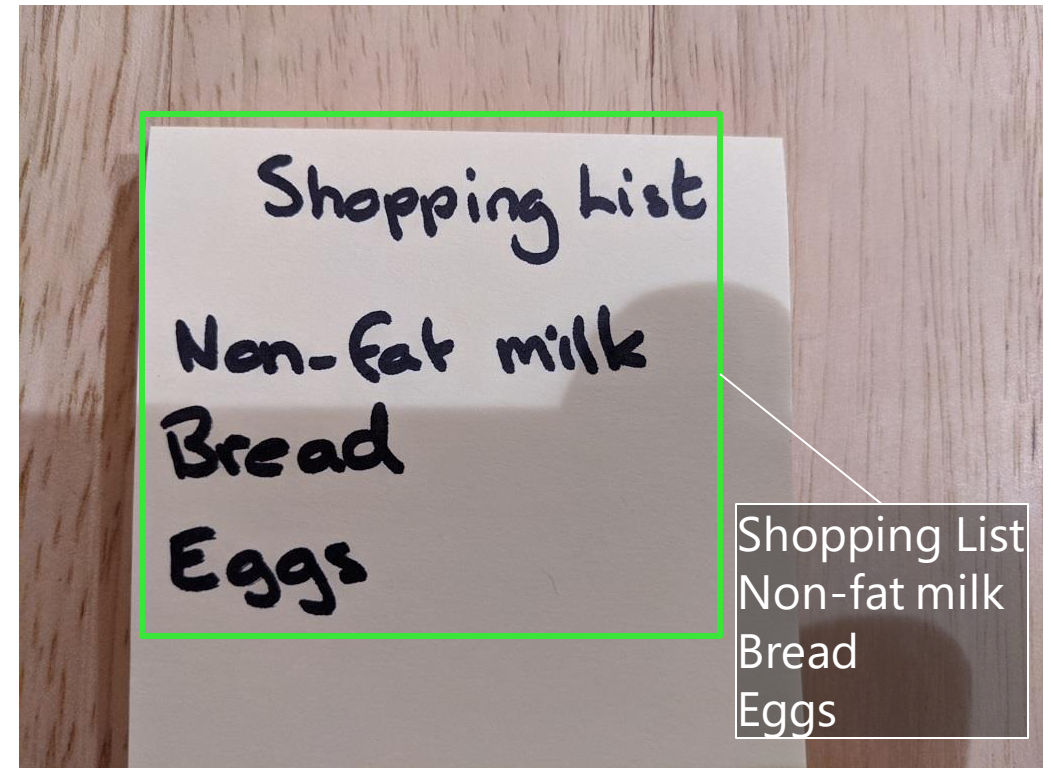
Analyzing Forms with the *Form Recognizer* Service

- 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

Northwind Traders

123 Main Street

555-123-4567

2/17/2020 13:07

1	Apple	$0.90
2	Orange	$1.60

Sub-Total	$2.50
Tax	$0.25
Total	$2.75

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Image Classification

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Explore Further on Microsoft Learn

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

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

Lesson 1: Introduction to National Language Processing

What is Natural Language Processing?

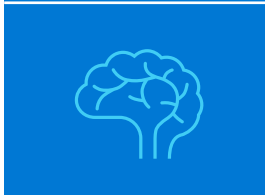Text analysis and entity recognition

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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Natural Language Processing

Lesson 2: Using Natural Language Processing Services
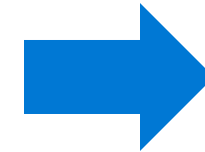
Text Analytics

I had a wonderful vacation in France.

- Predominant Language: English
- Sentiment: 88% (positive)
- Key Phrases: "wonderful vacation"
- Entities: France
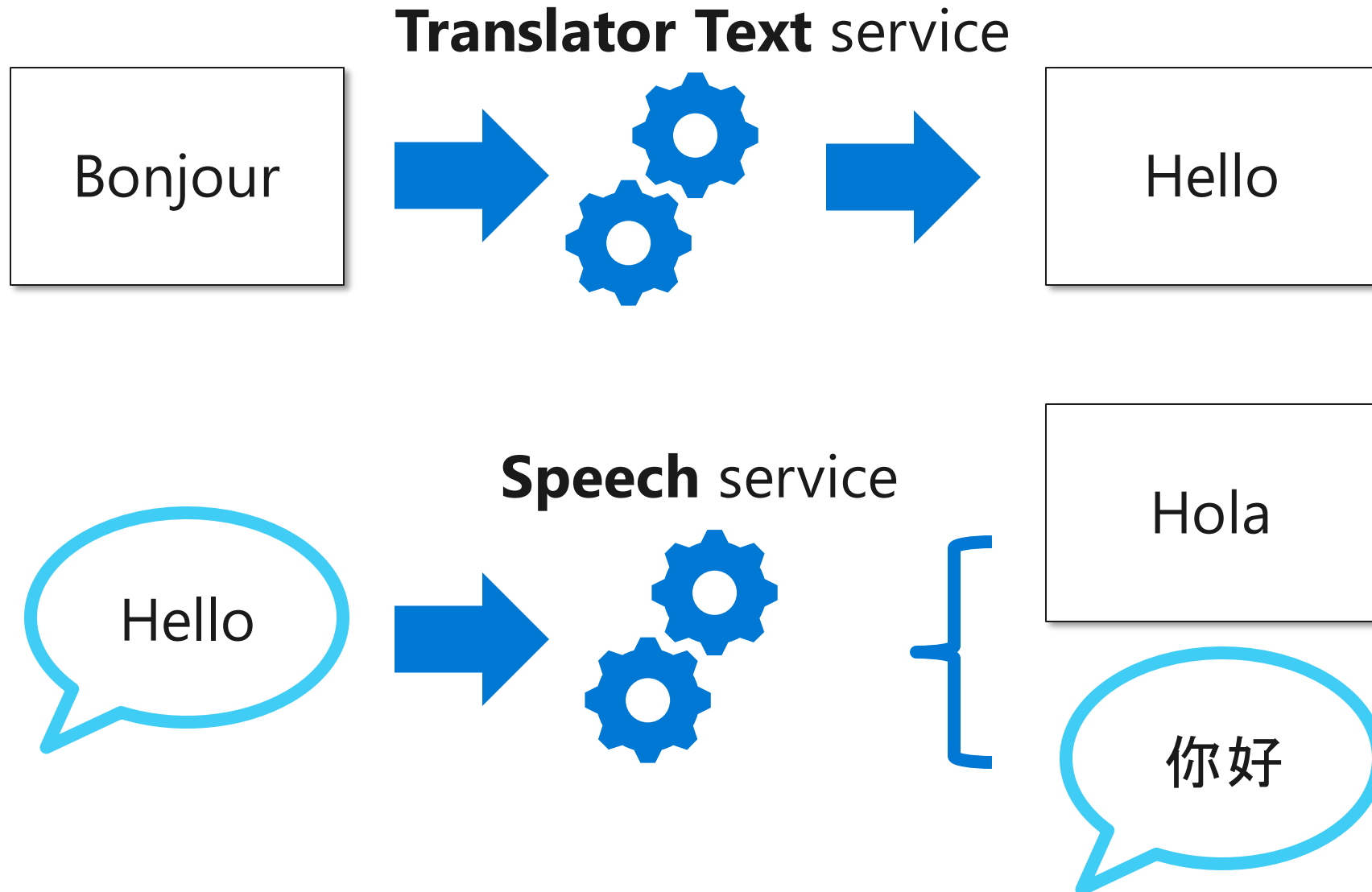
Speech Recognition and Synthesis
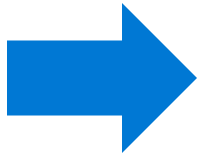
Use the *speech-to-text* capabilities of the **Speech** service to transcribe audible speech to text
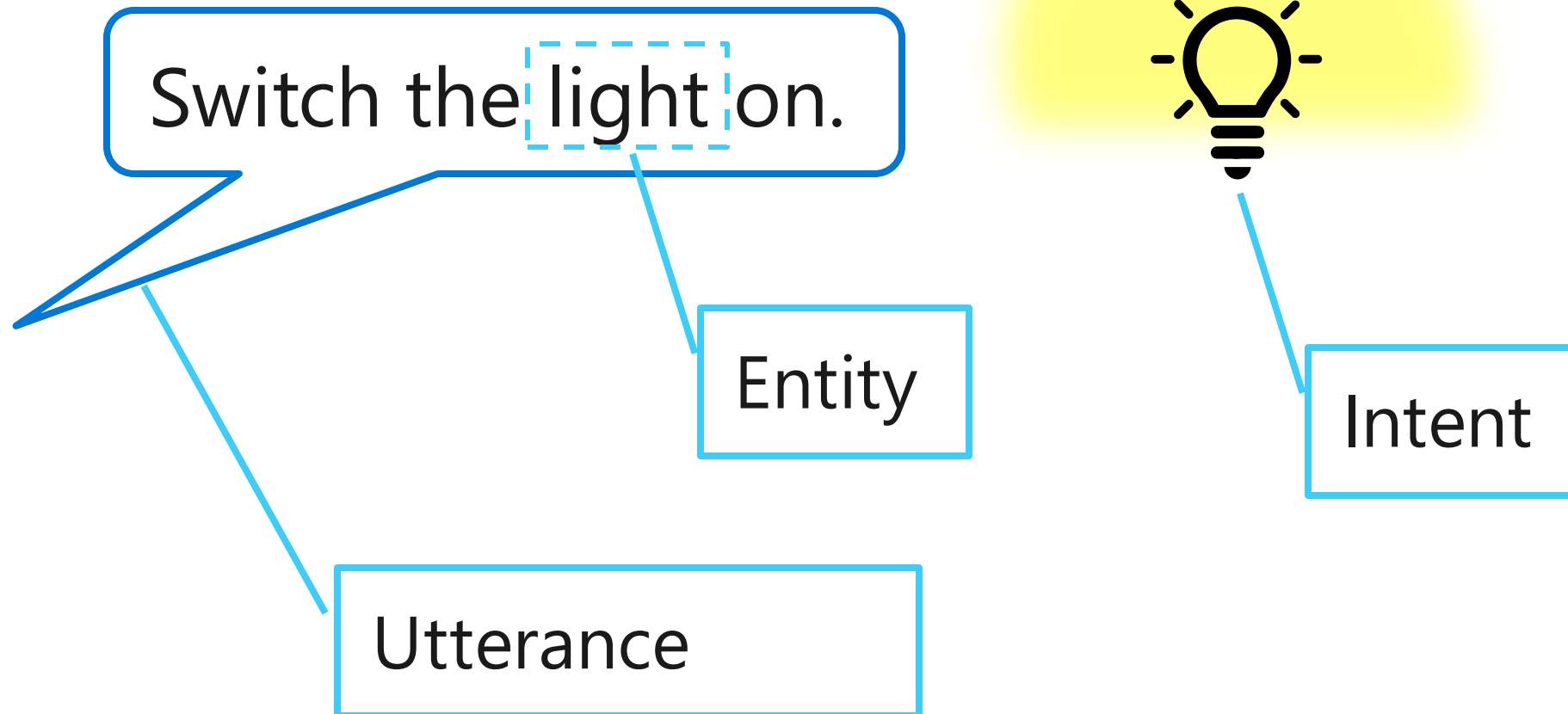
Use the *text-to-speech* capabilities of the **Speech** service to generate audible speech from text

Translation

Translator Text service

Bonjour → → Hello

Speech service

Hello → Hola / 你好

Language Understanding

Switch the light on.

Entity

Utterance

Intent

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Language
Understanding

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Explore Further on Microsoft Learn

Explore natural language processing
https://aka.ms/explore-nlp

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

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
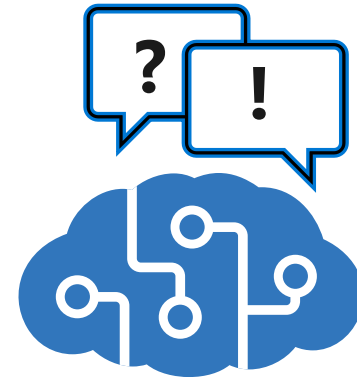9. Assume accountability for the bot's actions
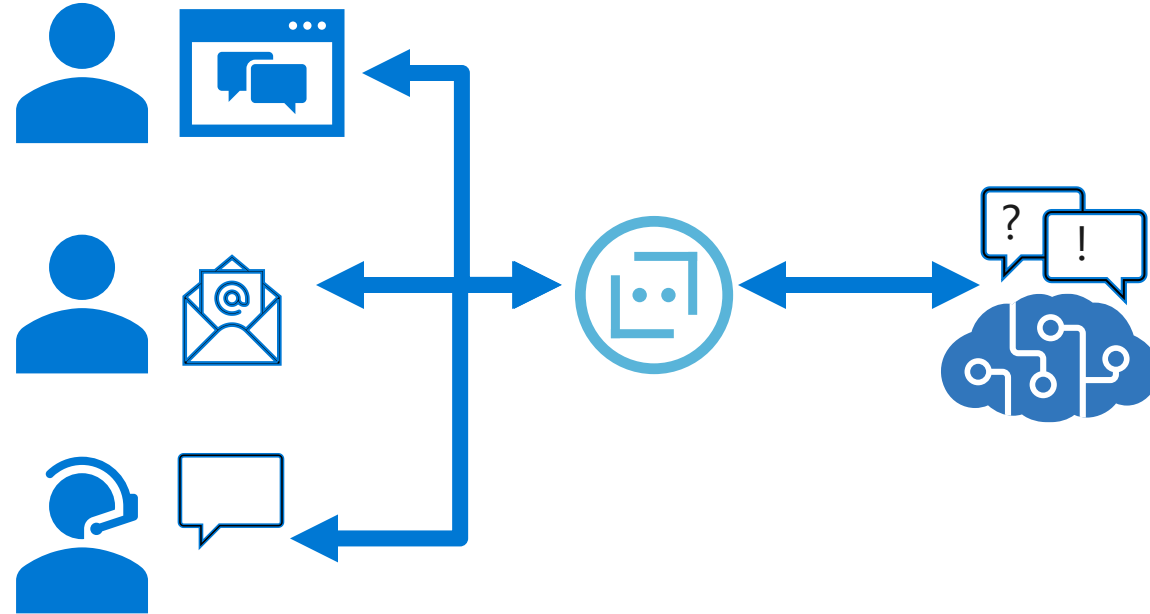
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Using a Bot

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

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

References

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