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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 <i>bots</i>), 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

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Explore Further on Microsoft Learn

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





Machine Learning

Learning Objectives

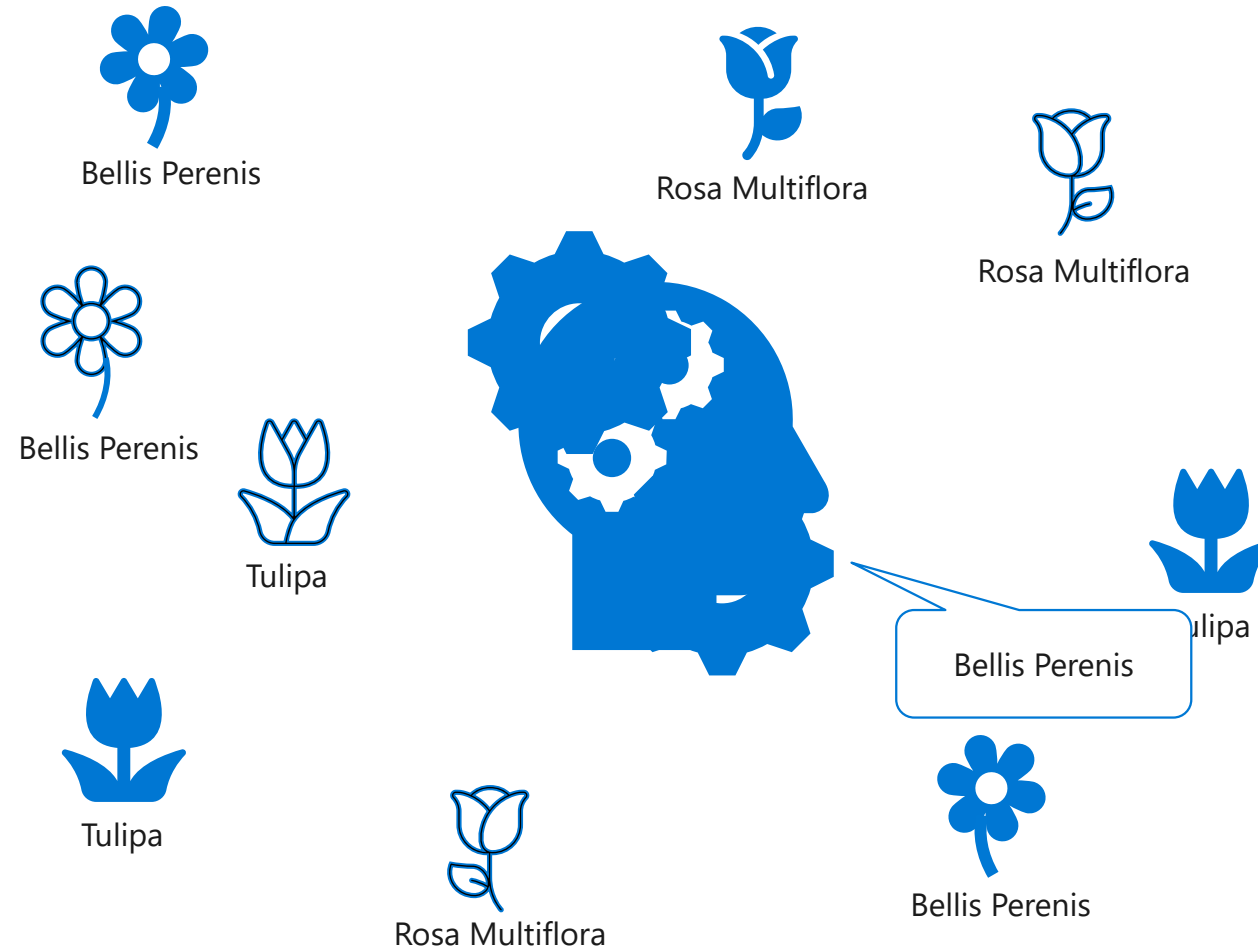
You will learn the following concepts:

- 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



Lesson 1: Introduction to Machine Learning

What is Machine Learning?

Creating predictive models by finding relationships in data

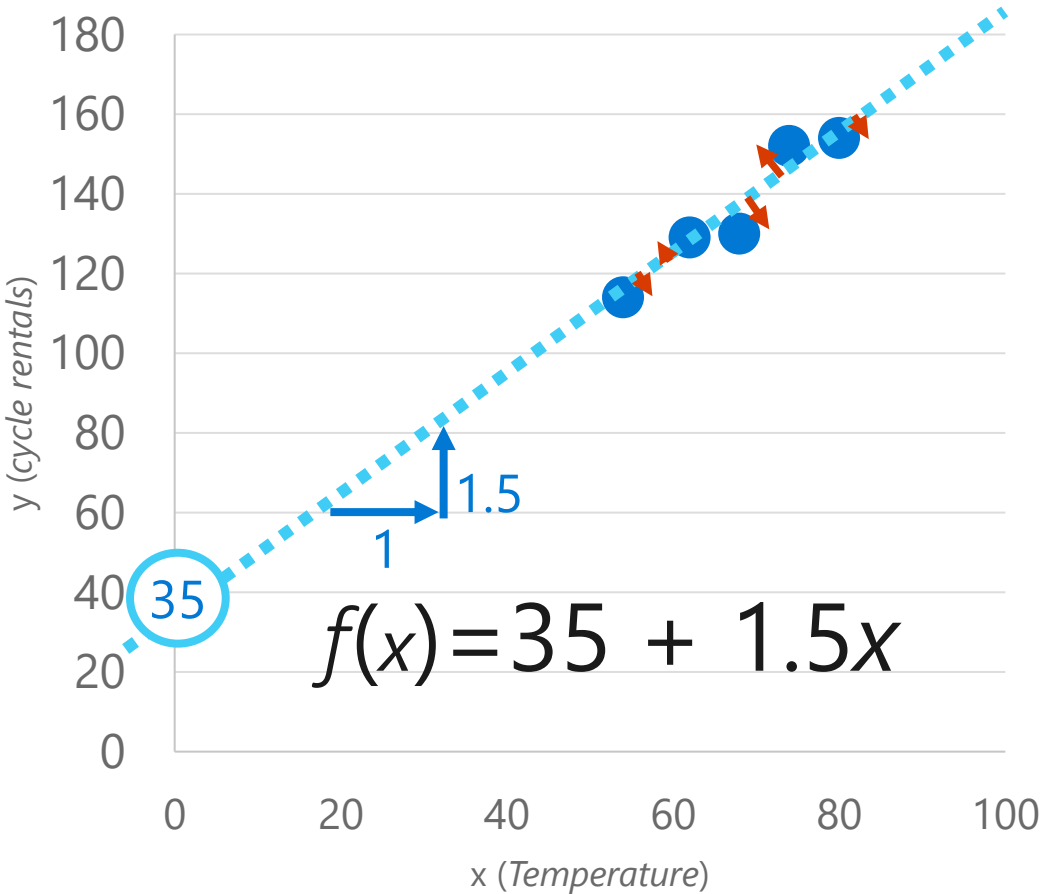


Regression


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

$f(x)$
 \hat{y}

116
128
137
146
155



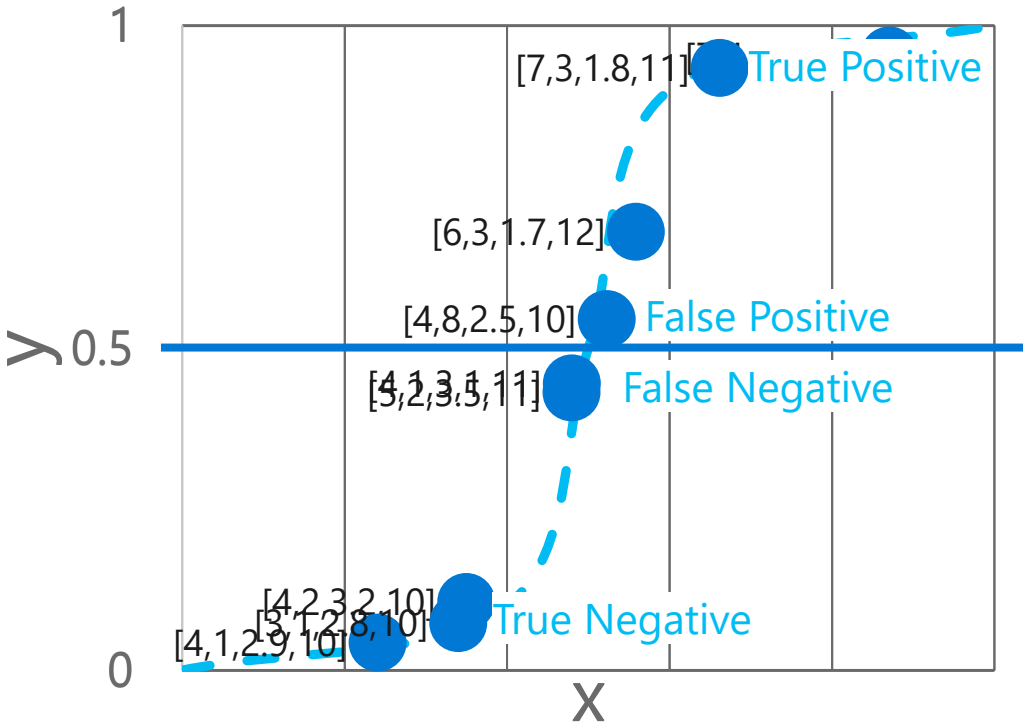
Classification

		
	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









	Predicted	
	1	0
Actual	1	0
	0	900

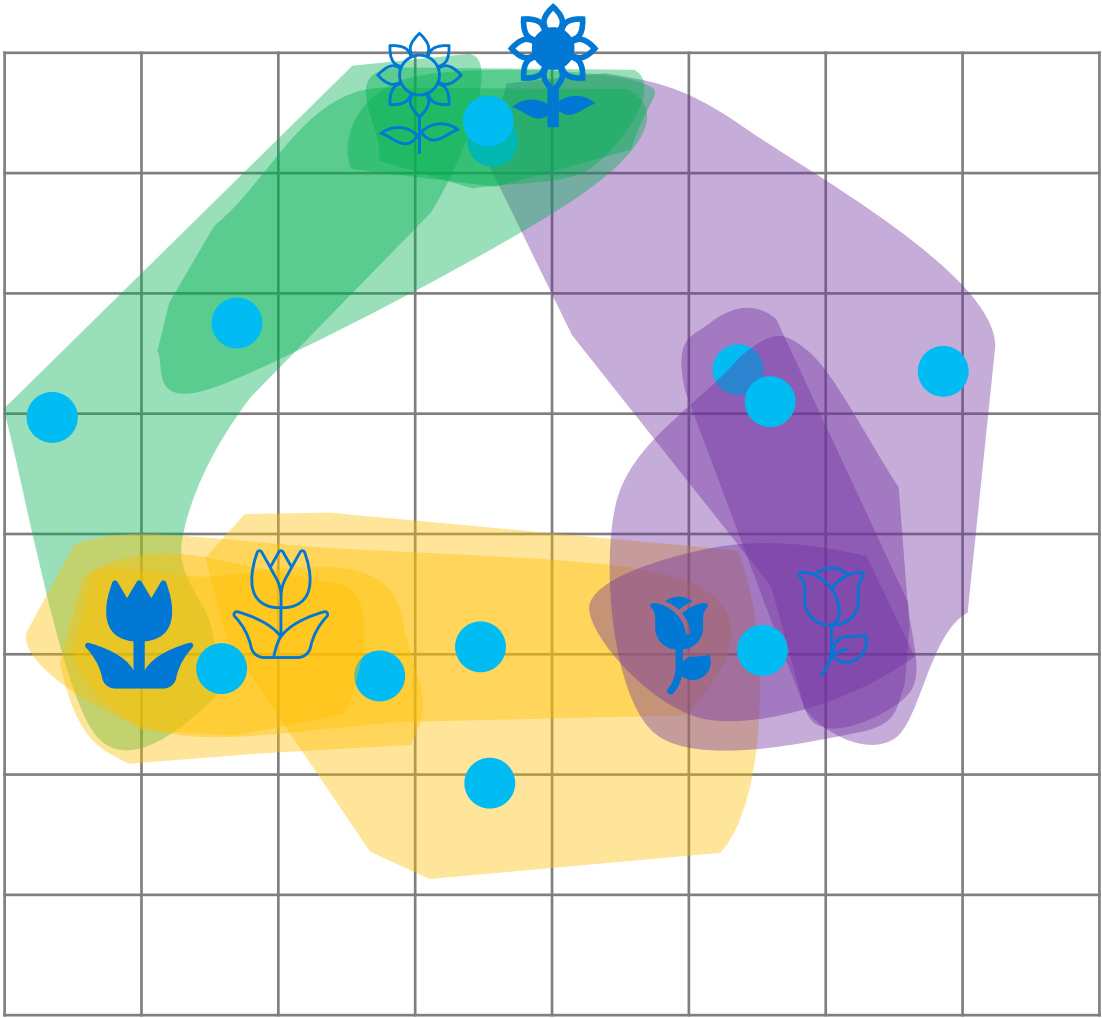
P(1)	P(0)	\hat{y}	
0.2	0.8	0	✓
0.9	0.1	1	✓
0.6	0.4	1	✗
0.3	0.7	0	✗

$(126 + 119) / (126 + 21 + 7 + 119)$
 $(0 + 900) / (0 + 50 + 50 + 900)$



Clustering

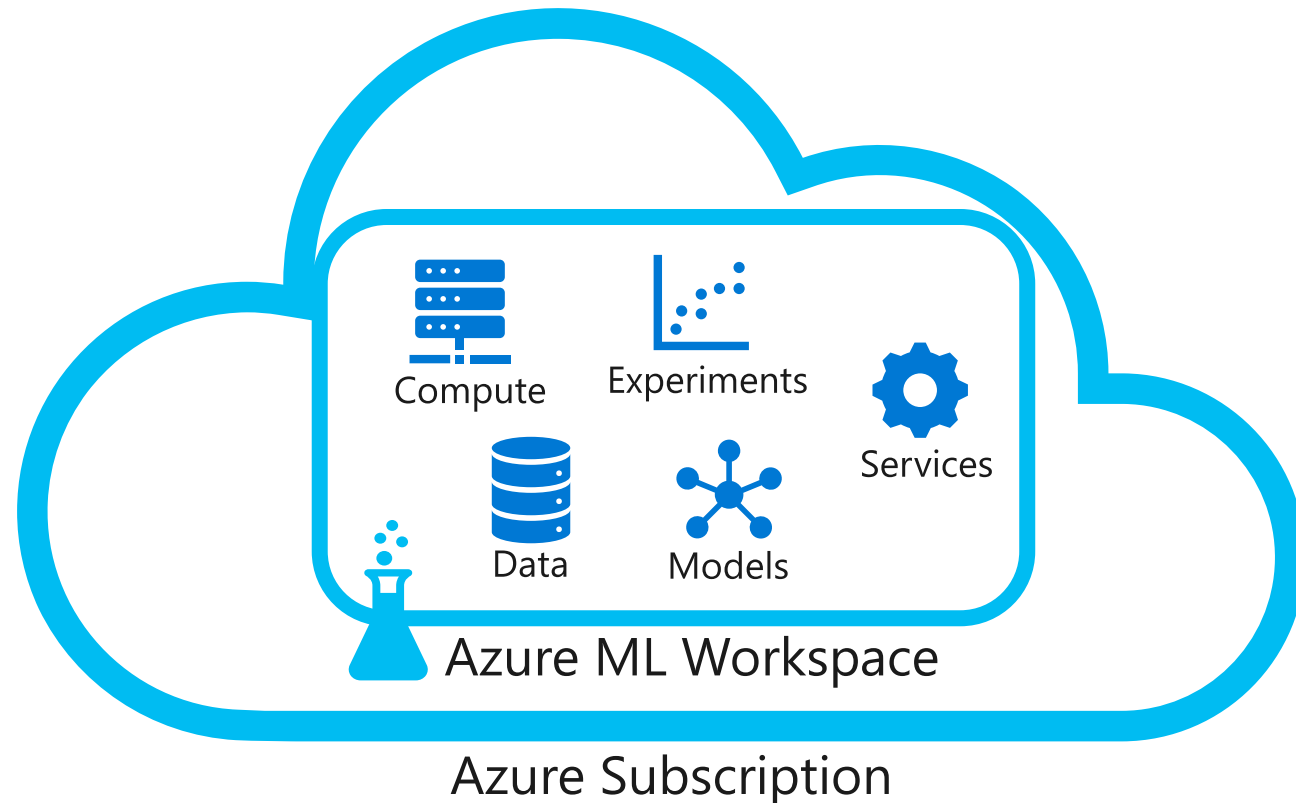
		
	6	3
	5	3
	2	3
	1	3
	3	8
	4	8



Lesson 2: Azure Machine Learning

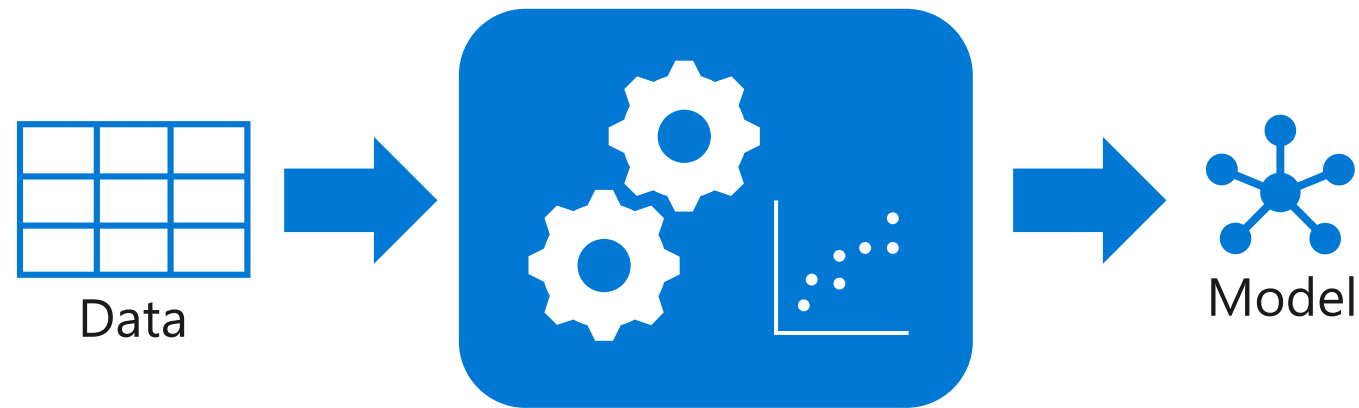
What is Azure Machine Learning?

A cloud-based platform for machine learning



Automated Machine Learning

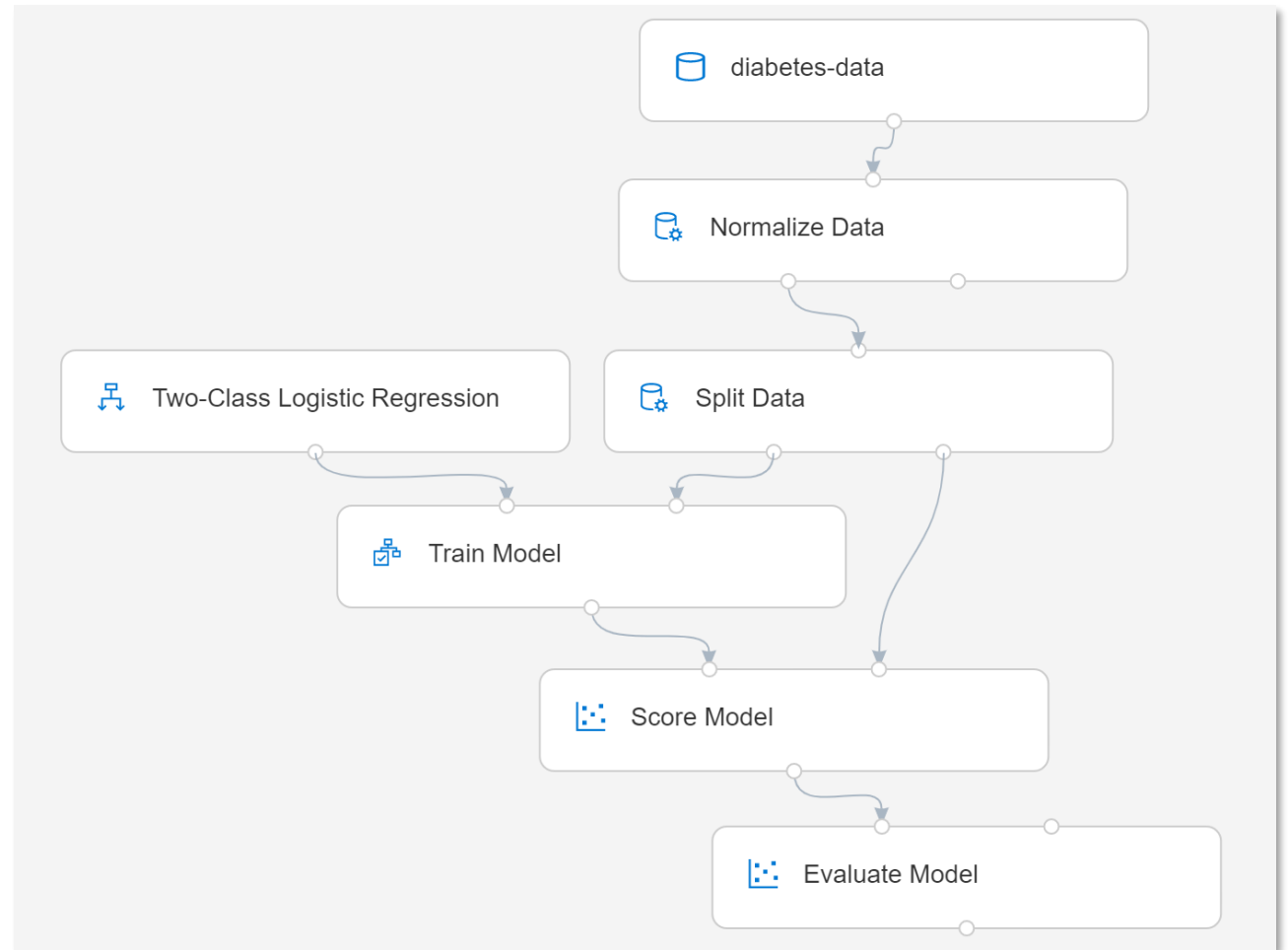
- Takes the hard work out of machine learning
 - Supply the data and desired model type, and let Azure Machine Learning find the best model



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

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Explore Further on Microsoft Learn

Create no-code predictive models with Azure Machine Learning

<https://aka.ms/no-code-ml>



Mod 3: Computer Vision

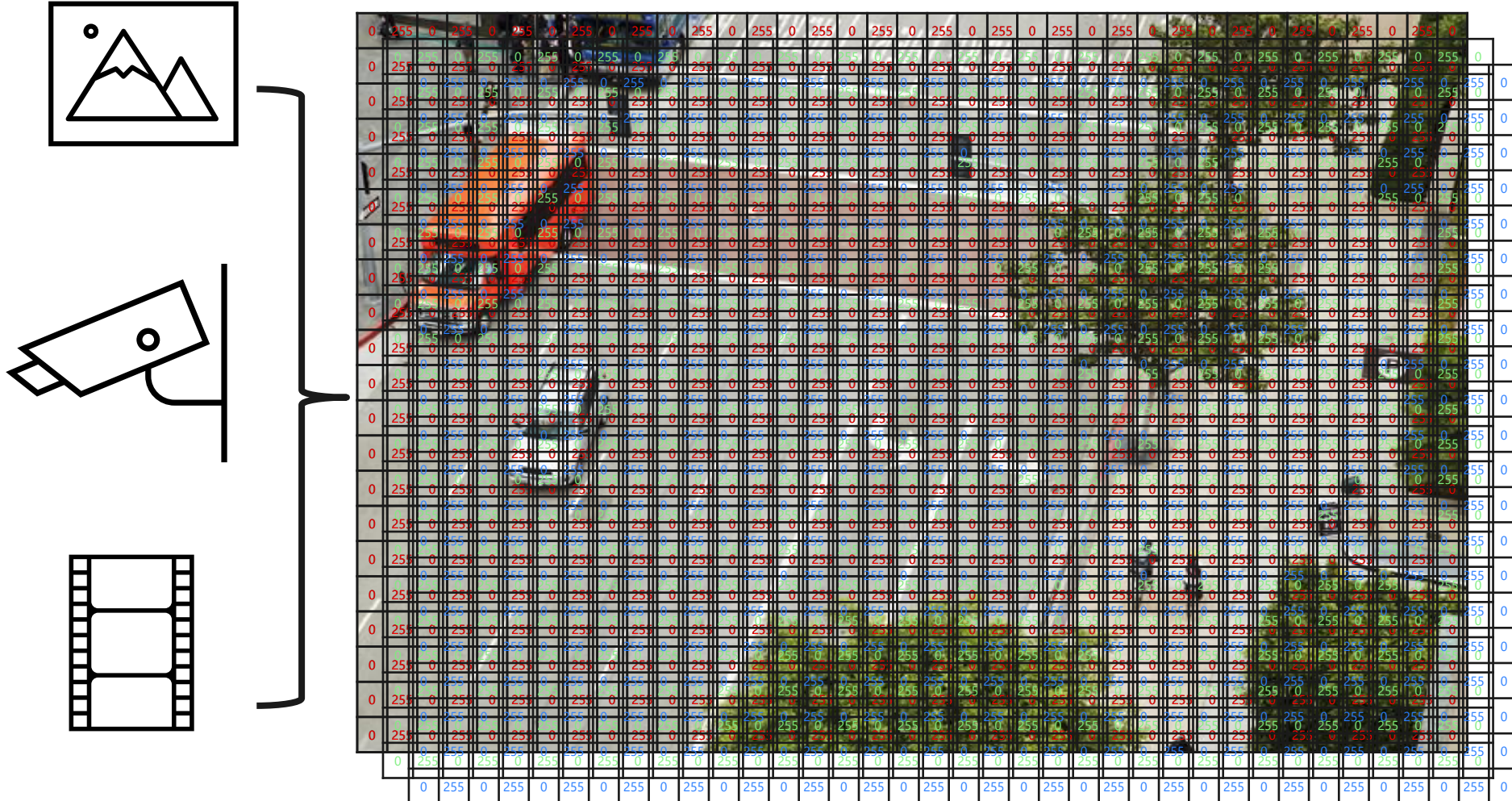
Learning Objectives

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?

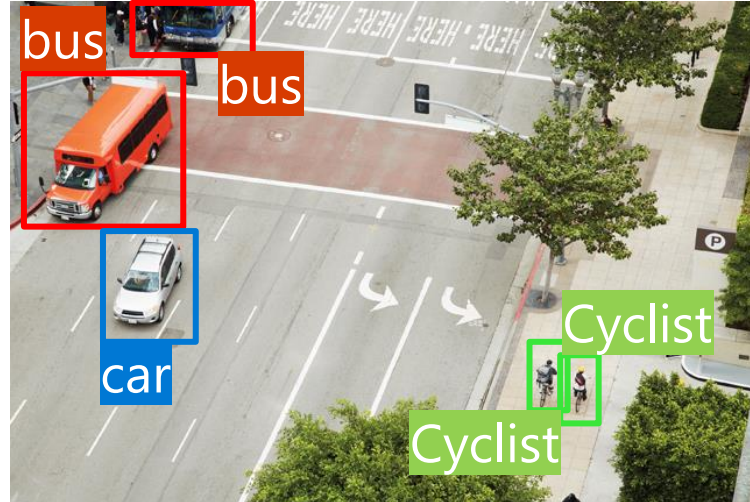


Applications of Computer Vision

Image Classification



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

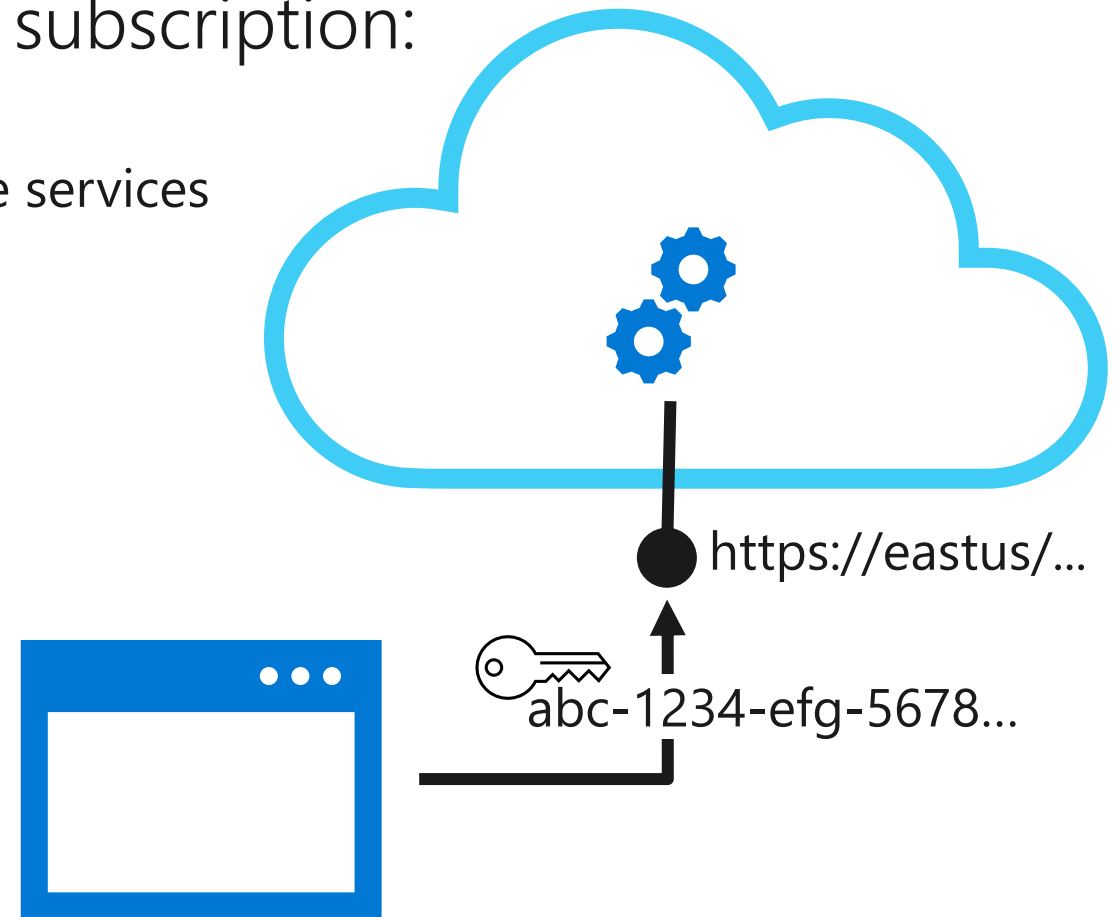
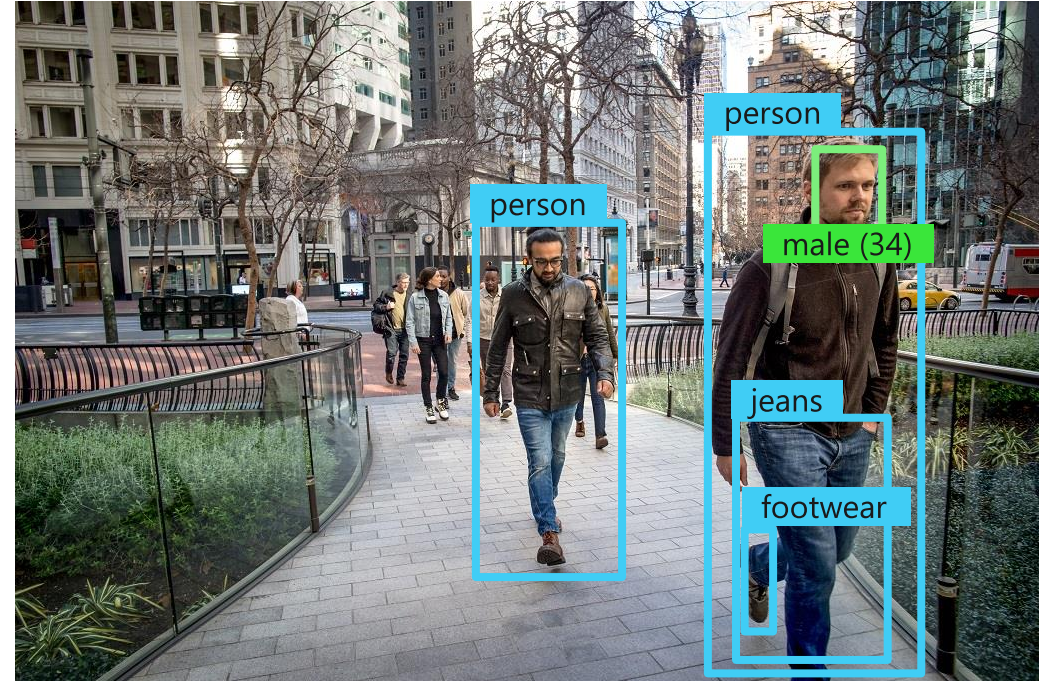


Image Analysis with the *Computer Vision Service*

- 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



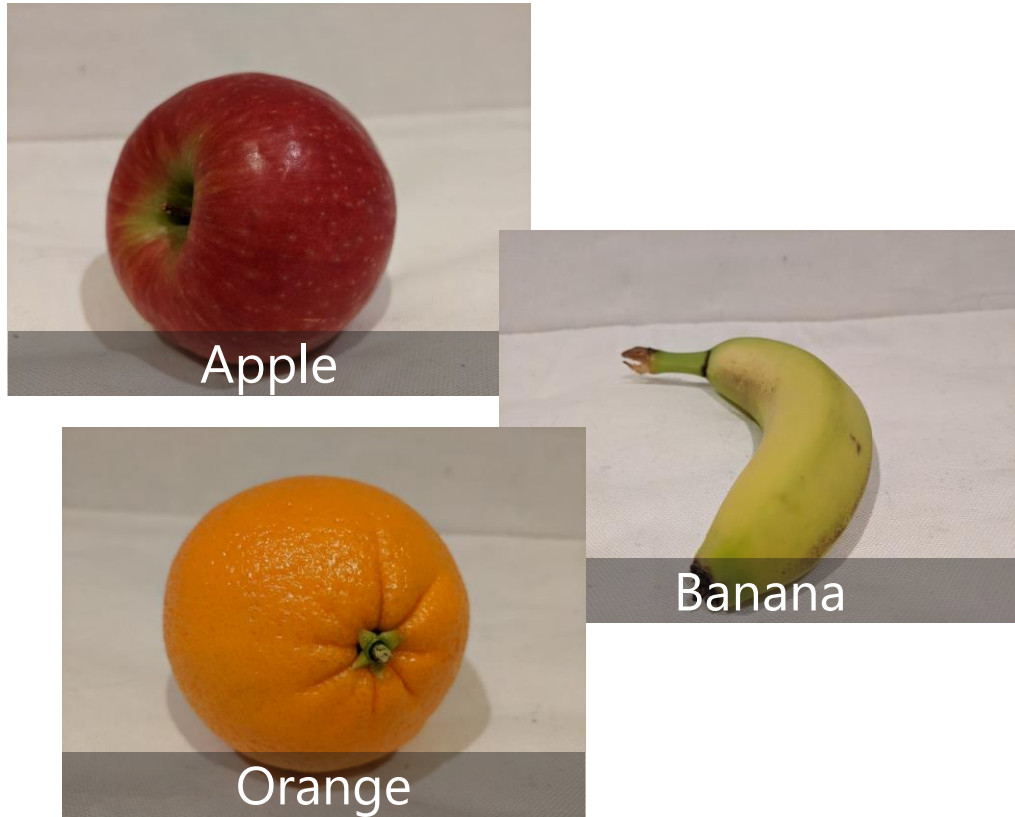
Caption: a group of people walking on a sidewalk

Tags: building, jeans, street, outdoor, jacket, city, person

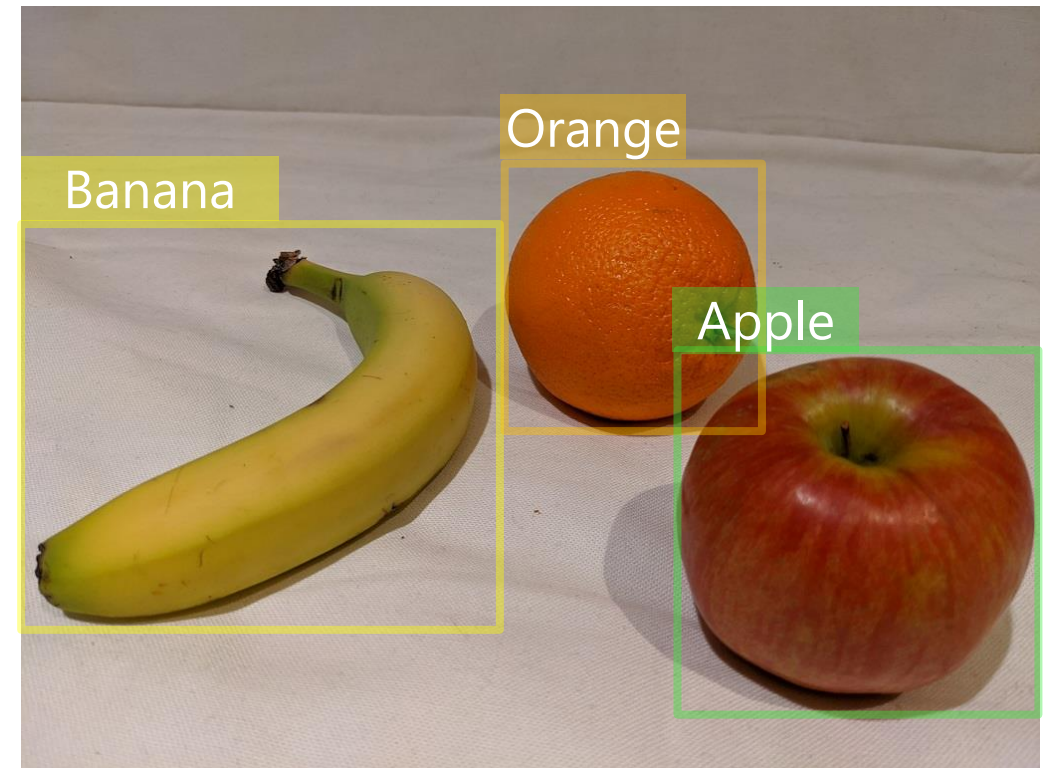
Ratings: Adult: False, Racy: False, Gore: False

Training Models with the *Custom Vision* Service

Image Classification

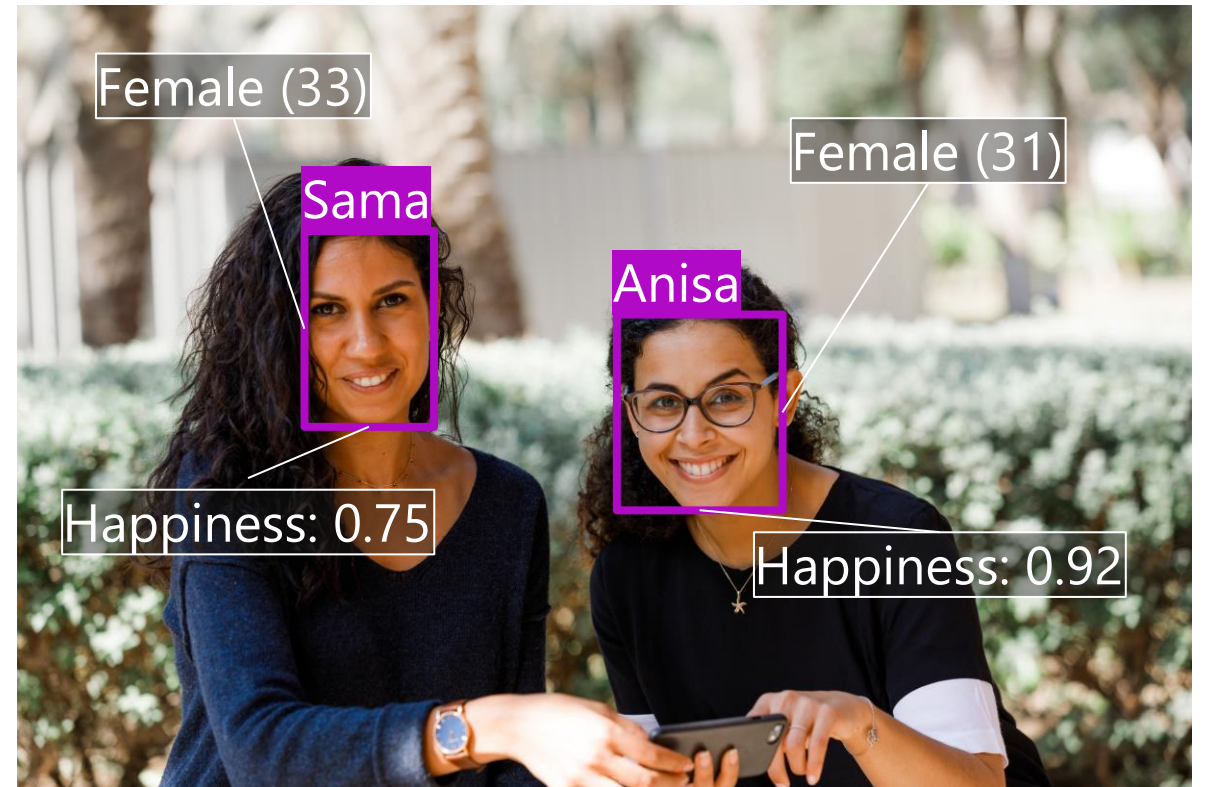


Object Detection



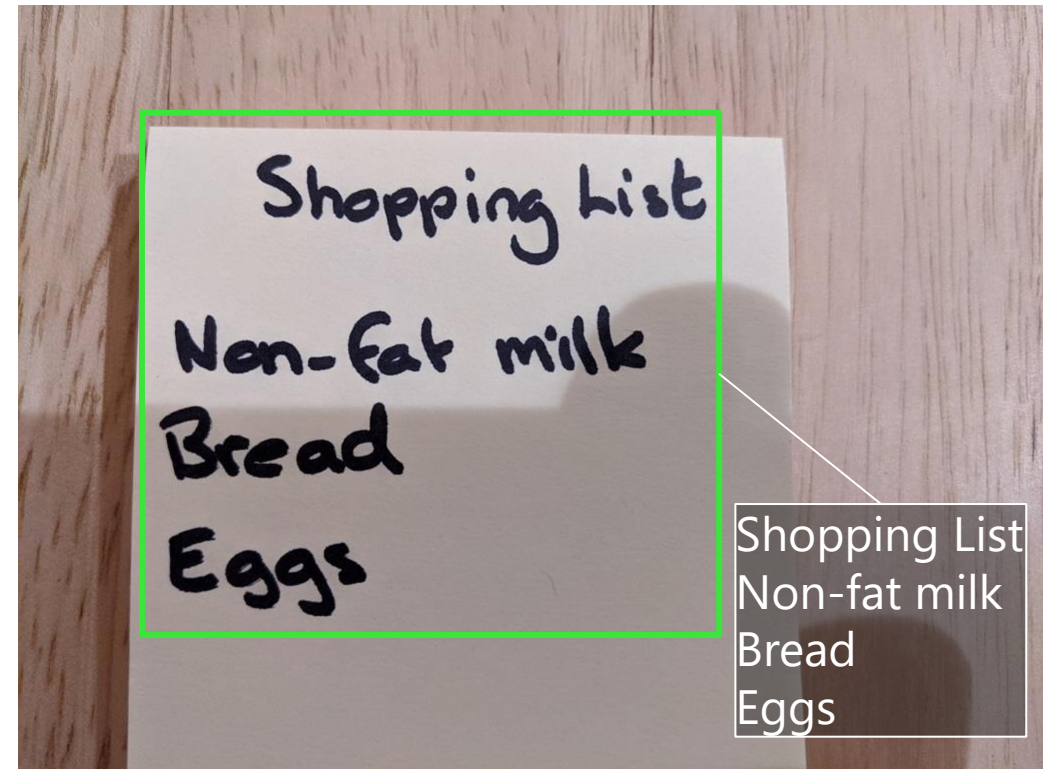
Analyzing Faces with the *Face* Service

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



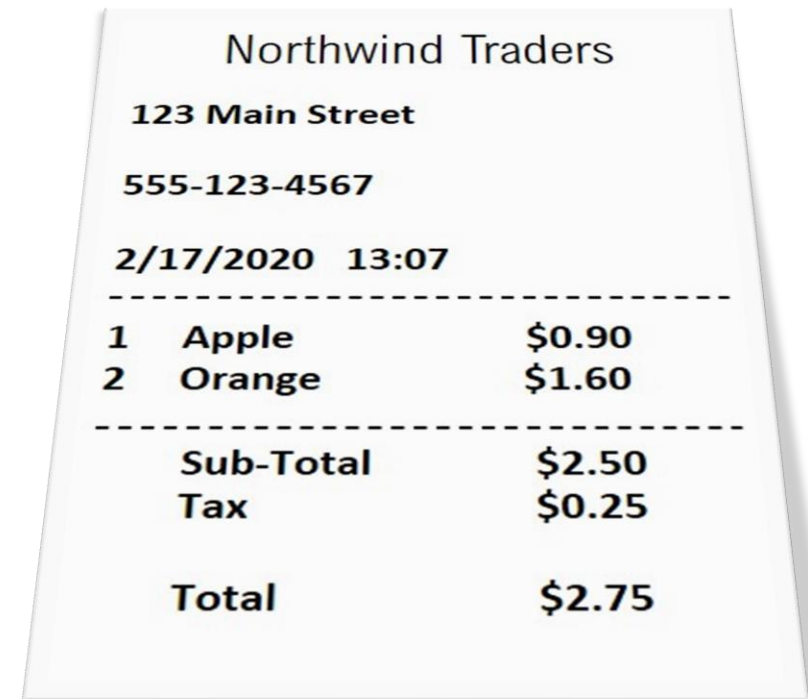
Reading Text with the *Computer Vision* Service

- 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



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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 - Analyzing Faces with the Face Service
 - Reading Text with the Computer Vision Service
 - Analyzing Forms with the Form Recognizer Service

Explore Further on Microsoft Learn

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



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

Lesson 1: Introduction to Natural 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

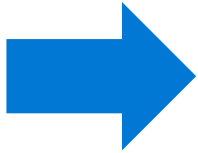
Lesson 2: Using Natural Language Processing Services

Text Analytics

I had a wonderful vacation in France.

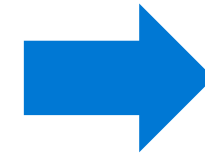
- **Predominant Language:** English
- **Sentiment:** 88% (positive)
- **Key Phrases:** "wonderful vacation"
- **Entities:** France

Speech Recognition and Synthesis

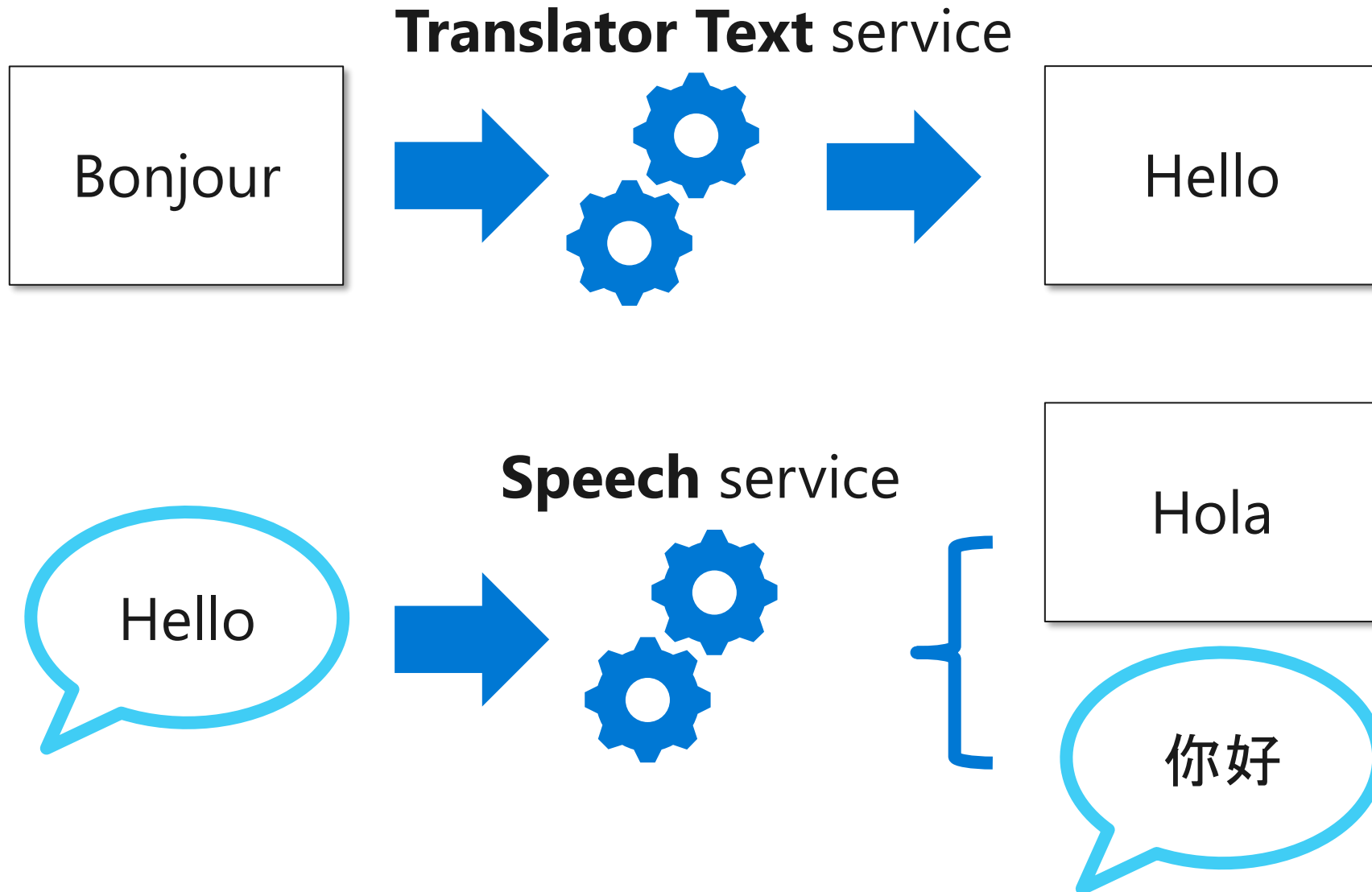


Use the *speech-to-text* capabilities of the **Speech** service to transcribe audible speech to text

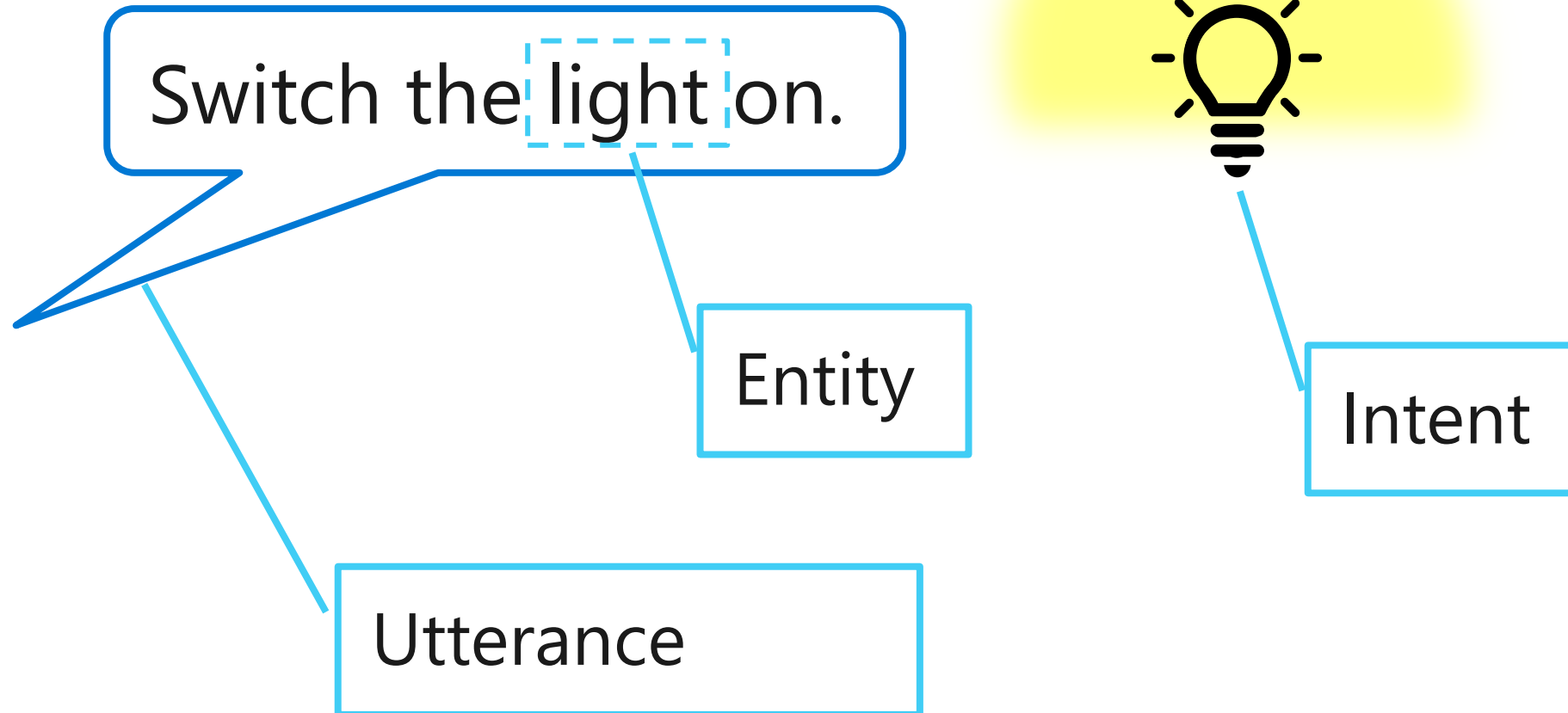
Use the *text-to-speech* capabilities of the **Speech** service to generate audible speech from text



Translation



Language Understanding



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Language
Understanding

Module Overview

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 - Speech Recognition and Synthesis
 - Translation
 - Language Understanding

Explore Further on Microsoft Learn

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





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

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

Hi. I'm the Adatum support bot. How can I help you?

Adatum Support at 10:50 AM

I have a question about my bill

You

OK. What's your account number?

Adatum Support at 10:50 AM

123-45-678A

You

Alright. I've found your details.
Is your question about:

1. The bill amount
2. The due date
3. Something else

Enter 1, 2, or 3

Type your message here ...

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

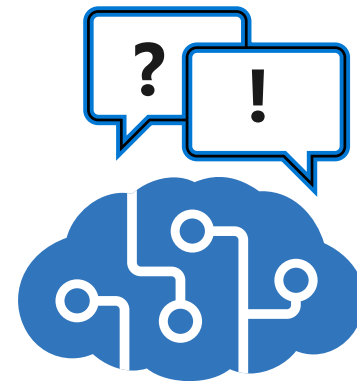
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Using a Bot

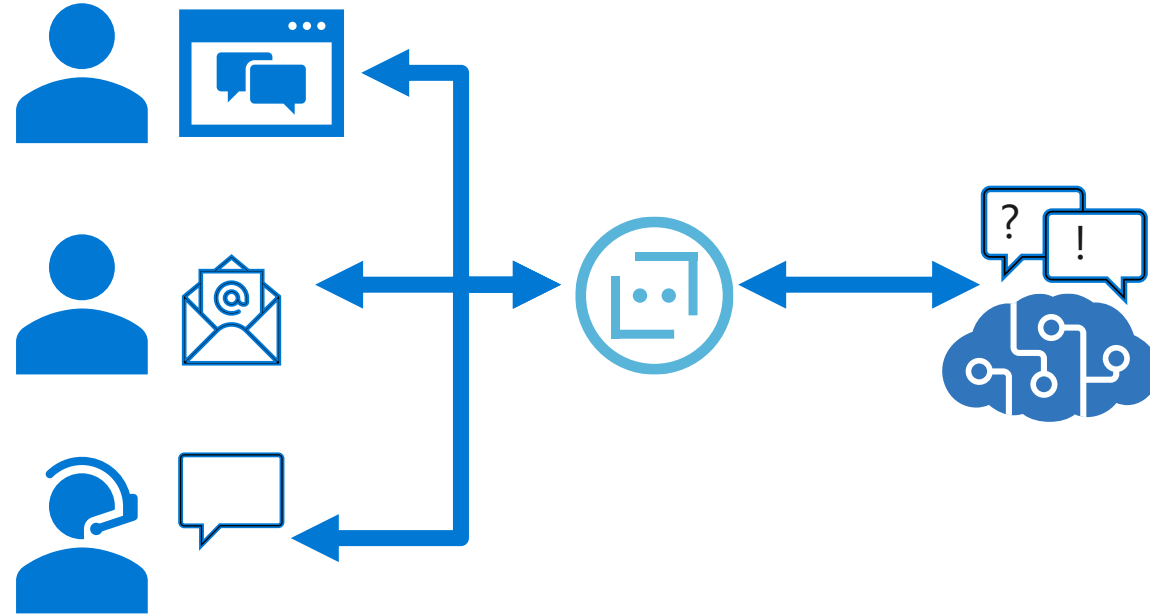
Lesson 2: Conversational AI in Azure

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

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 - Azure Bot Service

References

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

