Course Agenda

Module 1: Explore fundamentals of Artificial Intelligence

- Introduction to Artificial Intelligence
- Artificial Intelligence in Microsoft Azure

Module 2: Explore fundamentals of machine learning

- Introduction to Machine Learning
- Azure Machine Learning

Module 3: Explore fundamentals of computer vision

- Computer Vision Concepts
- Creating Computer Vision solutions in Azure

Module 4: Explore fundamentals natural language processing

- Introduction to Natural Language Processing
- Building Natural Language Solutions in Azure

Module 1:

Explore Fundamentals of Artificial Intelligence

- Lesson 1: Introduction to Artificial Intelligence
- Lesson 2: Artificial Intelligence in Microsoft Azure

What is Artificial Intelligence?

Software that imitates human capabilities

- Predicting outcomes and recognizing patterns based on historic data
- Recognizing abnormal events and making decisions
- Interpreting visual input
- Understanding language, and engaging in conversations
- Extracting information from sources to gain knowledge

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, and engage in dialogs with human users
 Knowledge Mining	Extract information from data sources to create a searchable knowledge store

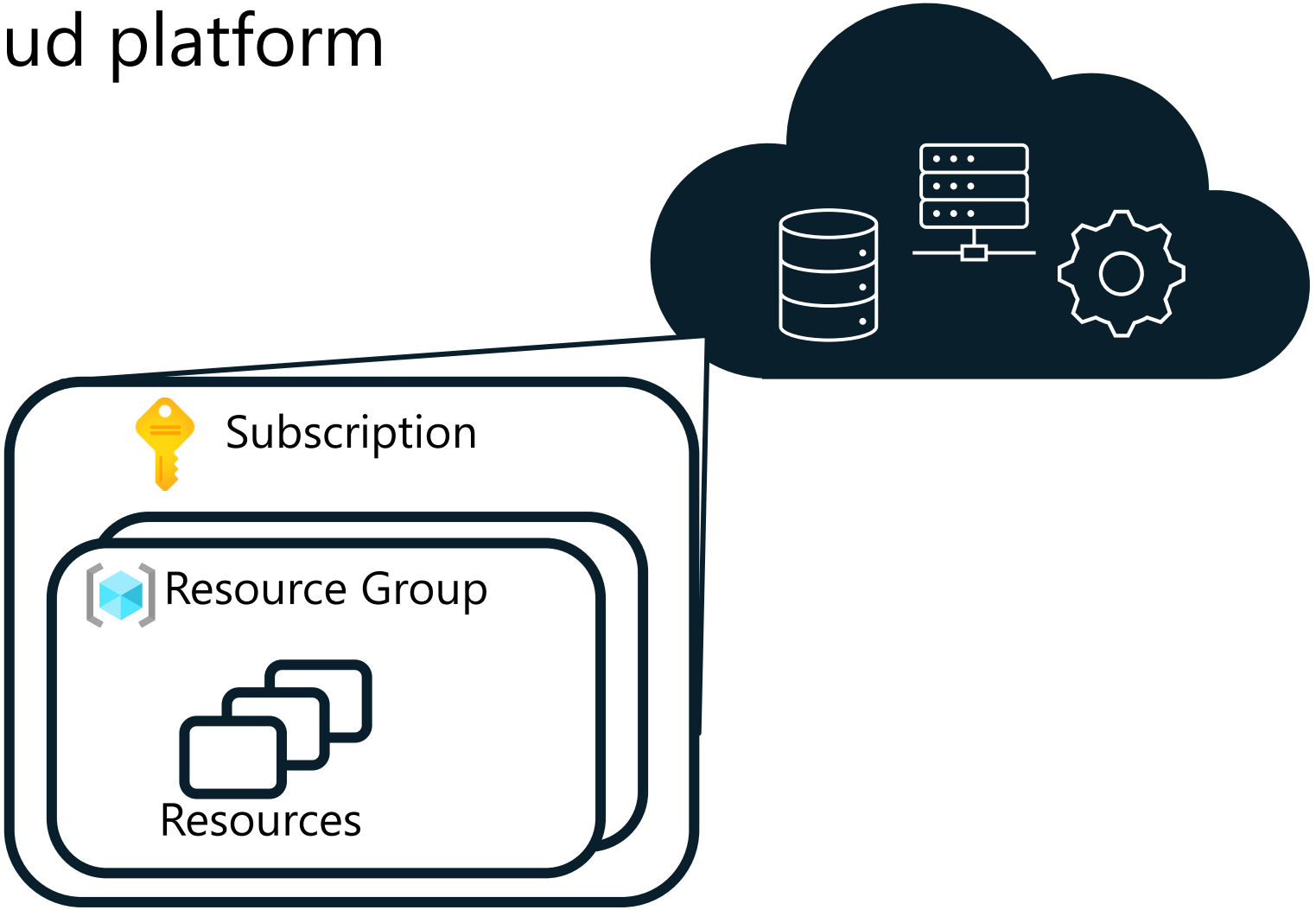
Principles of Responsible AI

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

Azure Basics

Scalable, reliable cloud platform

- Data storage
- Compute
- Services



AI Services in Microsoft Azure

Azure Machine Learning	A platform for training, deploying, and managing machine learning models
Cognitive Services	A suite of services with four main pillars: Vision, Speech, Language, Decision
Azure Bot Service	A cloud-based platform for developing and managing conversational bots
Azure Cognitive Search	Data extraction, enrichment, and indexing for intelligent search and knowledge mining

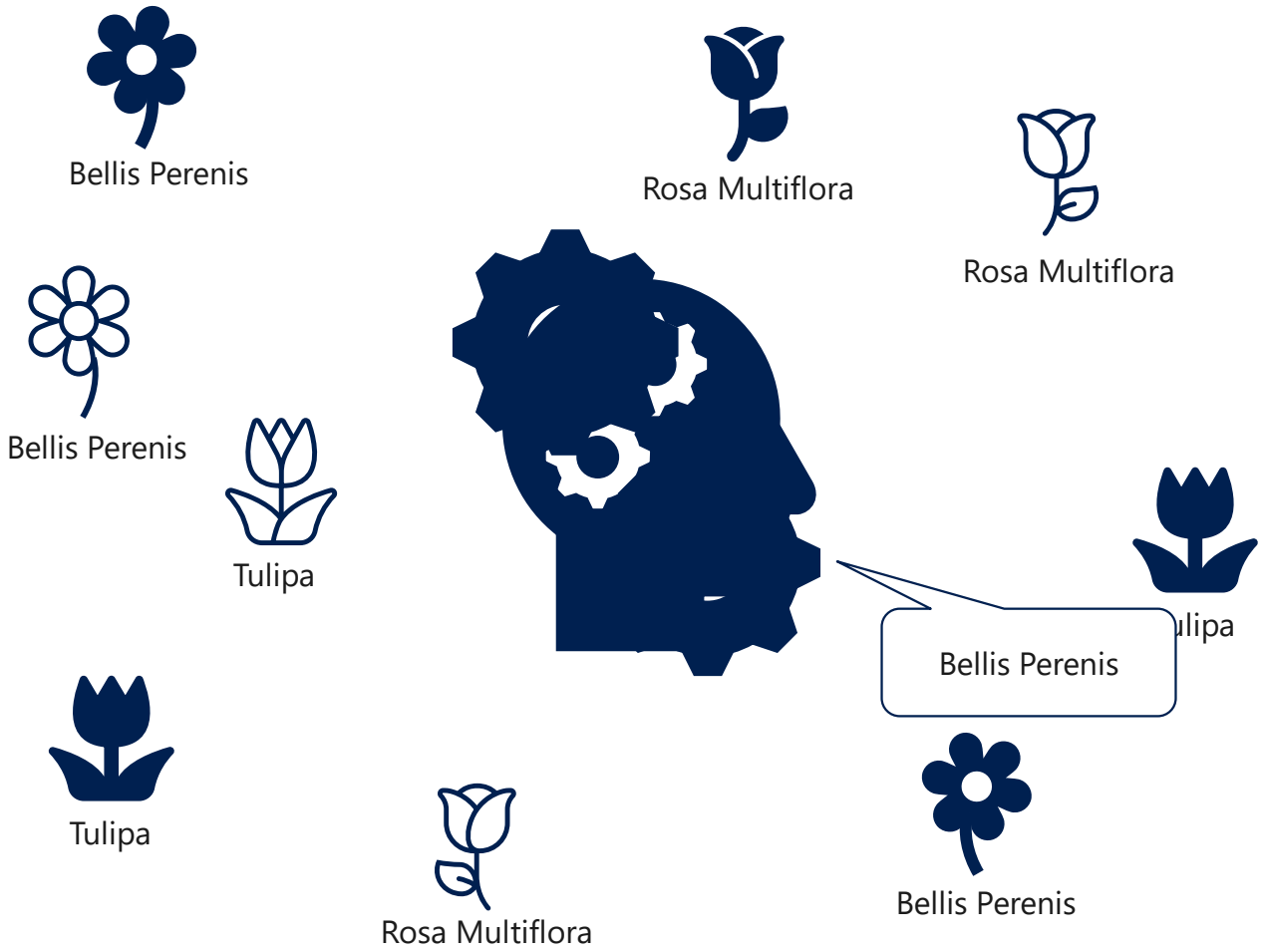
Module 2:

Explore Fundamentals of Machine Learning

- Lesson 1: Introduction to Machine Learning
- Lesson 2: Azure Machine Learning

What is Machine Learning?

Creating predictive models by finding relationships in data



1. A botanist collects some samples of flowers
2. Each sample has a set of *features* (characteristics) and a *label* (the species)
3. An algorithm is used to find the relationship between the features and the label
4. The result is a *model* that encapsulates those relationships
5. The model can predict the label of a new sample based on its features

Types of Machine Learning

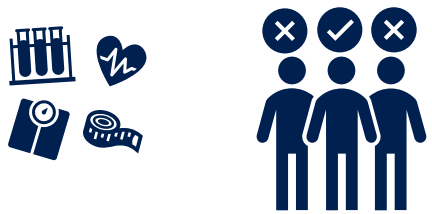
Machine Learning

Supervised Machine Learning
Training data includes known labels

Regression
Label is a numeric value

Predict the number of bike rentals based on day, season, and weather

Classification
Label is a categorization (or *class*)



Predict whether a patient is at-risk for diabetes based on clinical measurements

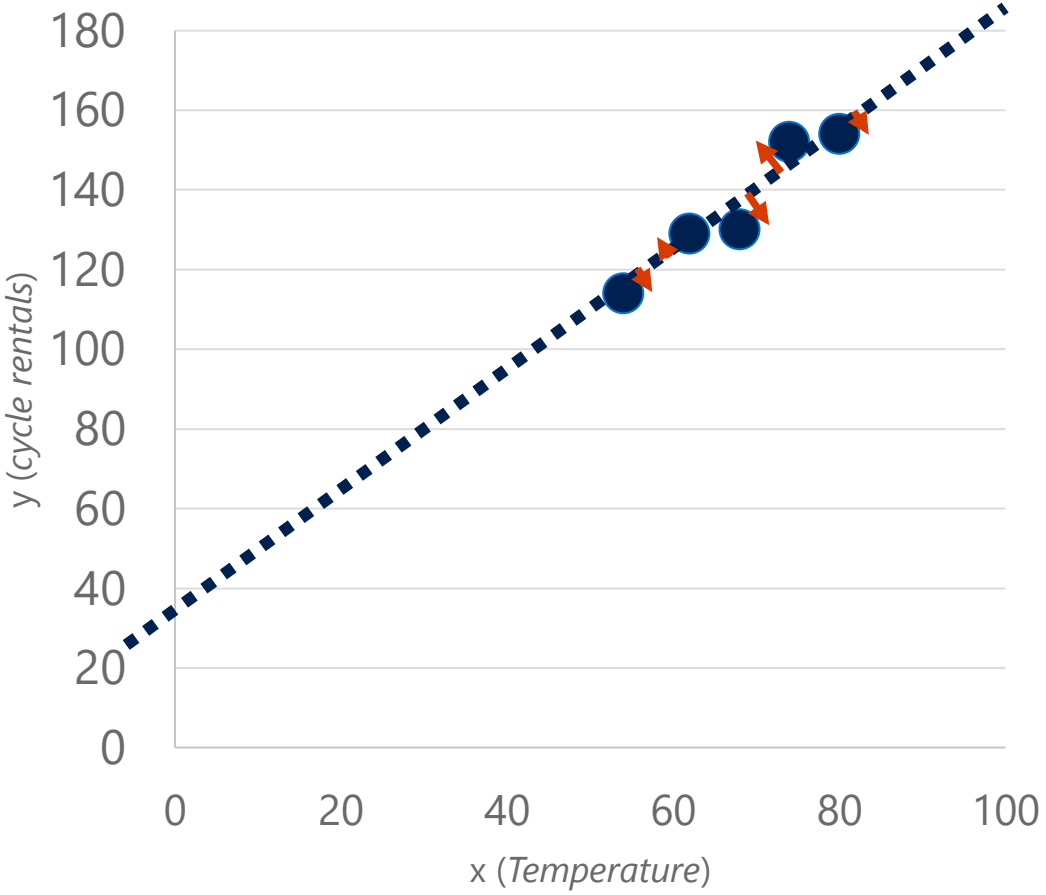
Unsupervised Machine Learning
Training data is unlabeled

Clustering
Similar items are grouped together

Vehicles with similar emissions and fuel efficiency characteristics are separated into clusters

Regression

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

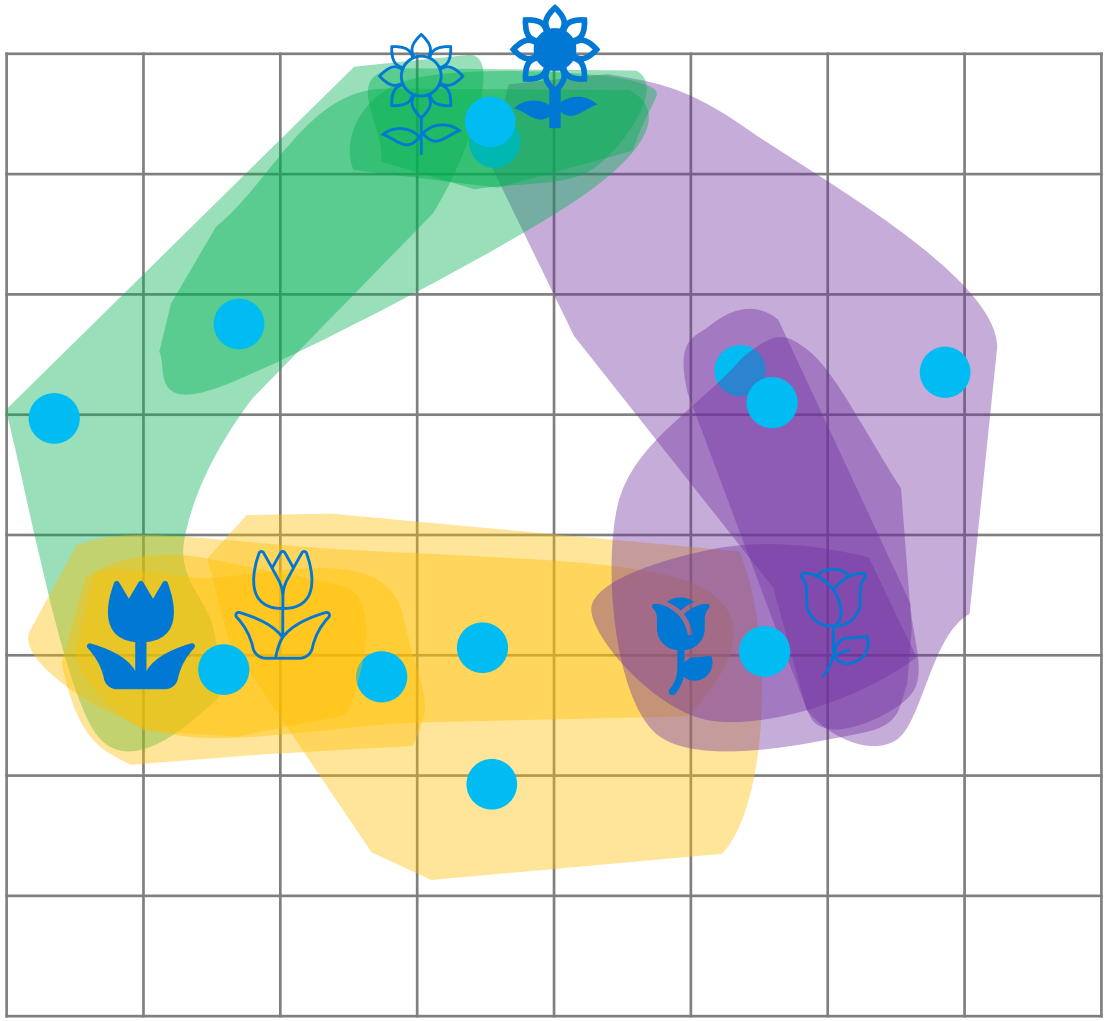


Classification

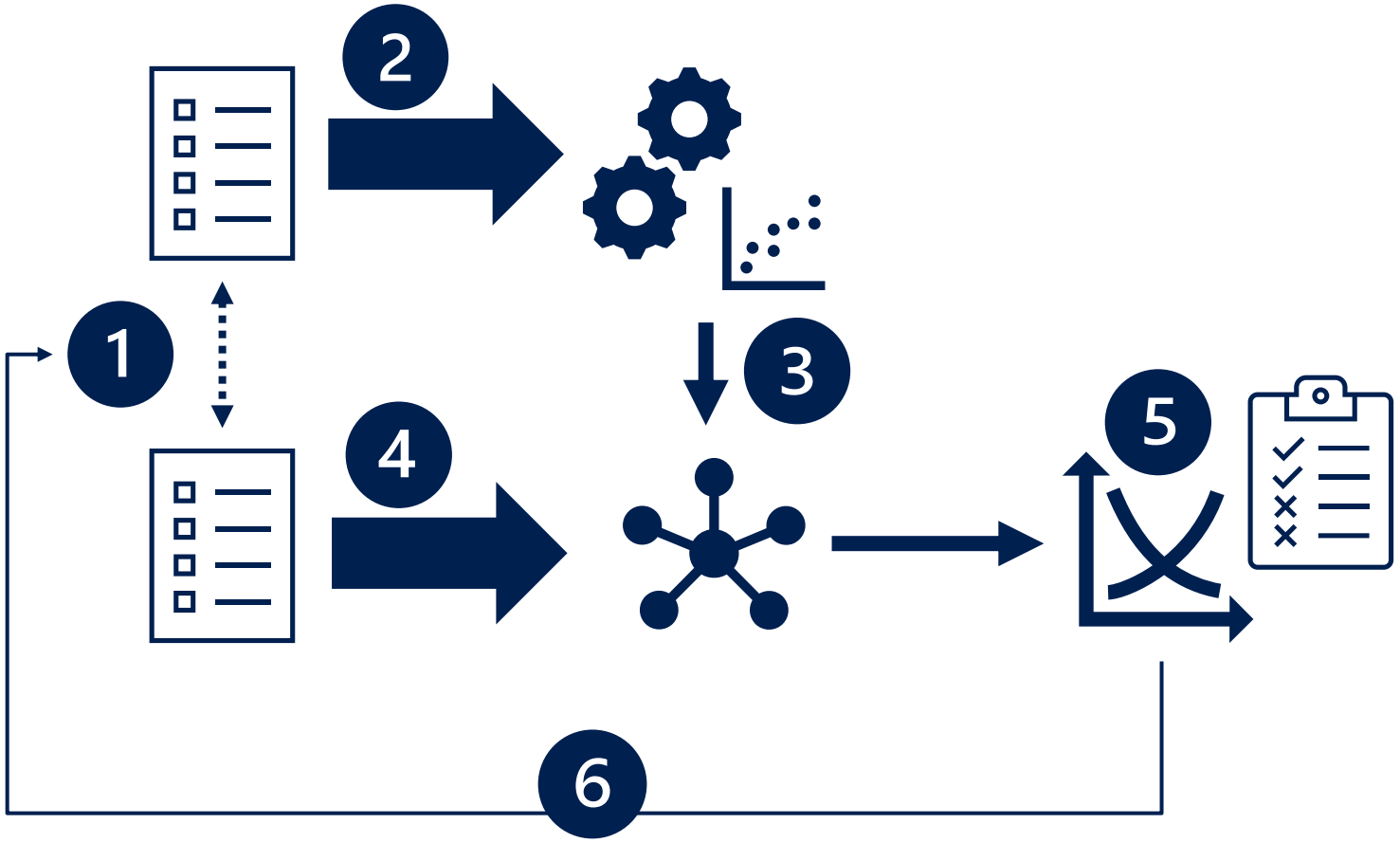
	 x	 y
Training	[4,2,3.2,10]	0
	[6,3,1.7,12]	1
	[5,2,3.5,11]	0
	[4,1,2.9,10]	0
	[7,4,2.1,11]	1
Validation	[3,1,2.8,10]	0
	[7,3,1.8,11]	1
	[4,8,2.5,10]	0
	[4,1,3,1,11]	1

Clustering

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



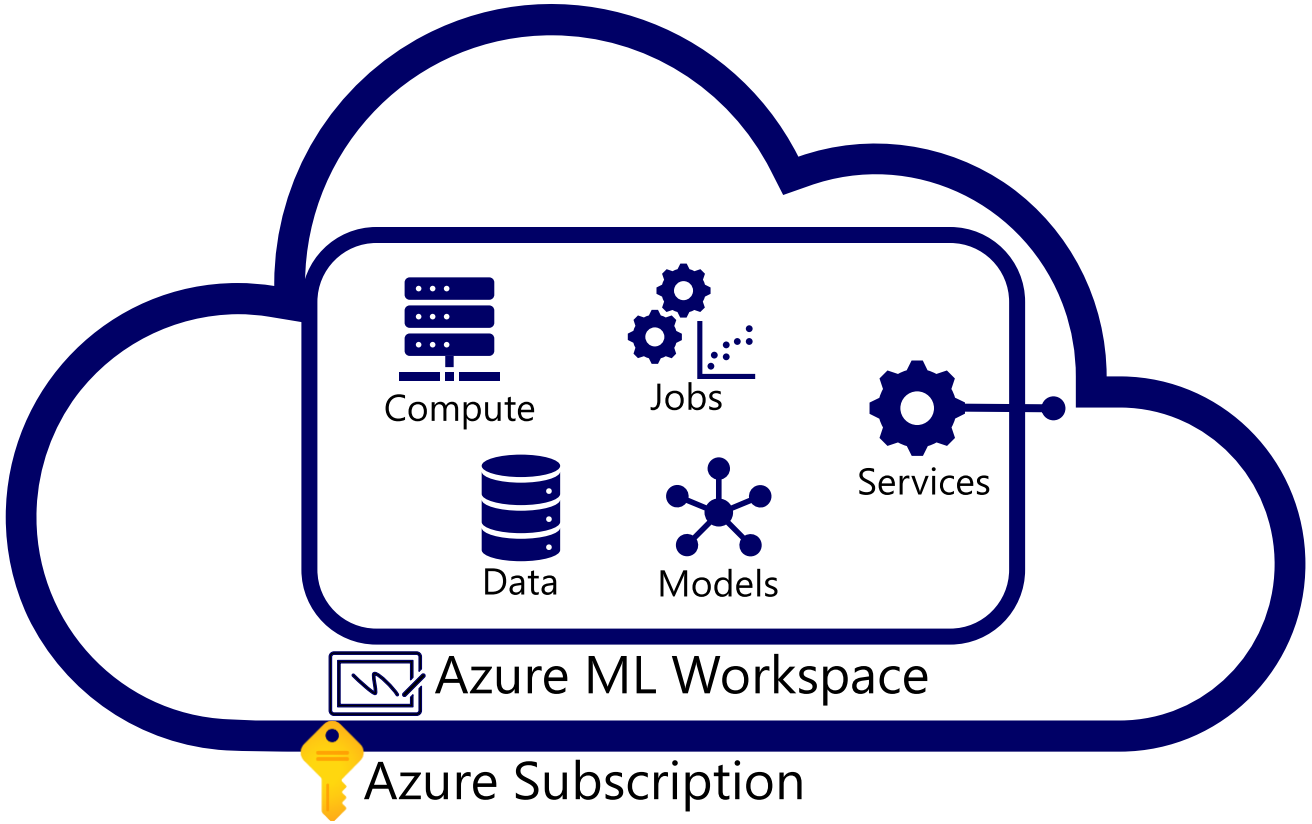
Model Training and Validation



1. Split the data into a *training* set and a *validation* set
2. Apply an algorithm to *fit* the training data to a model
3. The trained model encapsulates the relationships in the data
4. Use the model to generate predictions from the validation data
5. Use evaluation metrics to compare predicted vs actual labels (supervised) or measure cluster separation (unsupervised)
6. Repeat…

What is Azure Machine Learning?

A cloud-based platform for machine learning



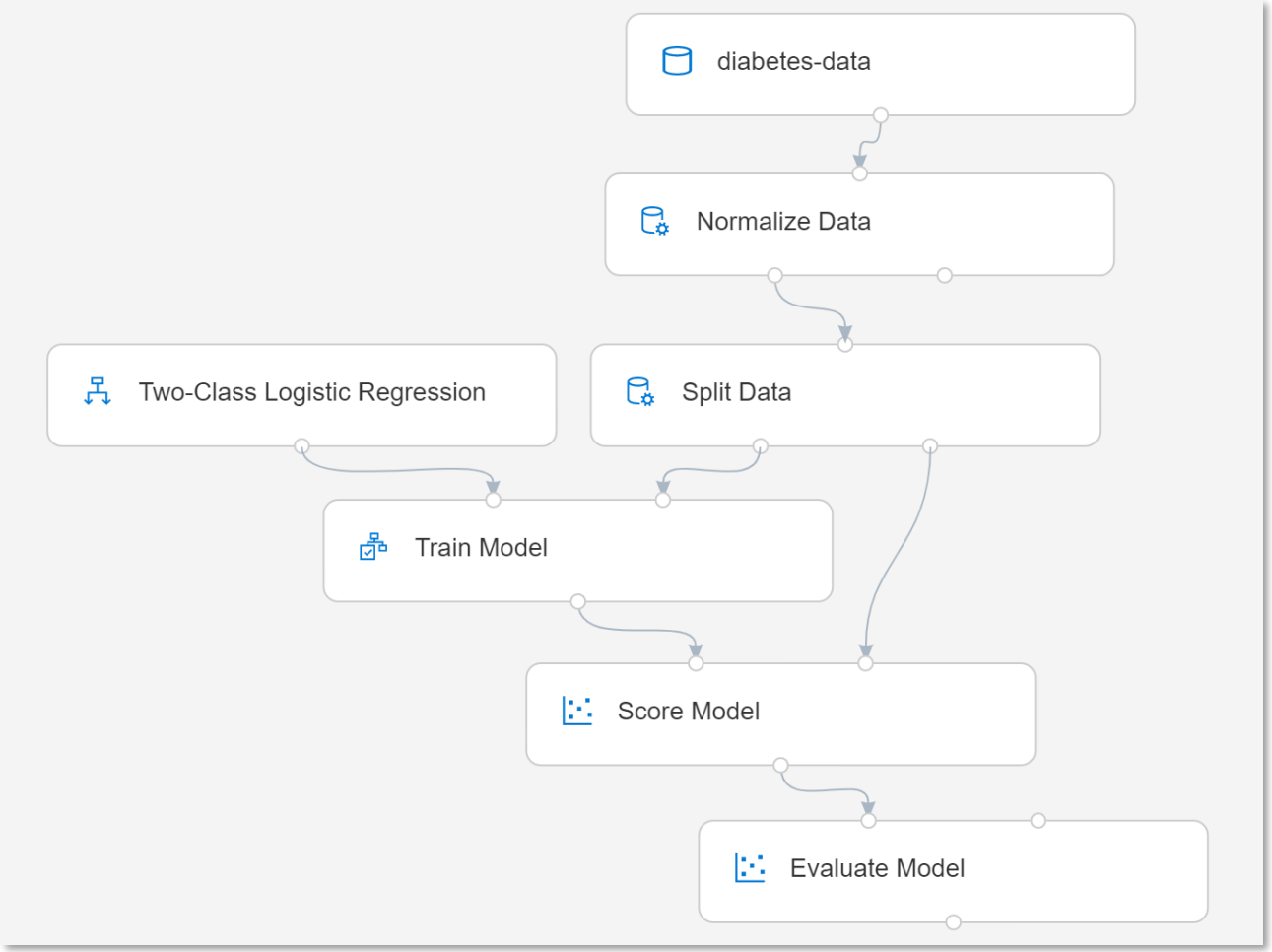
Automated Machine Learning

Supply the data and desired *supervised* 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

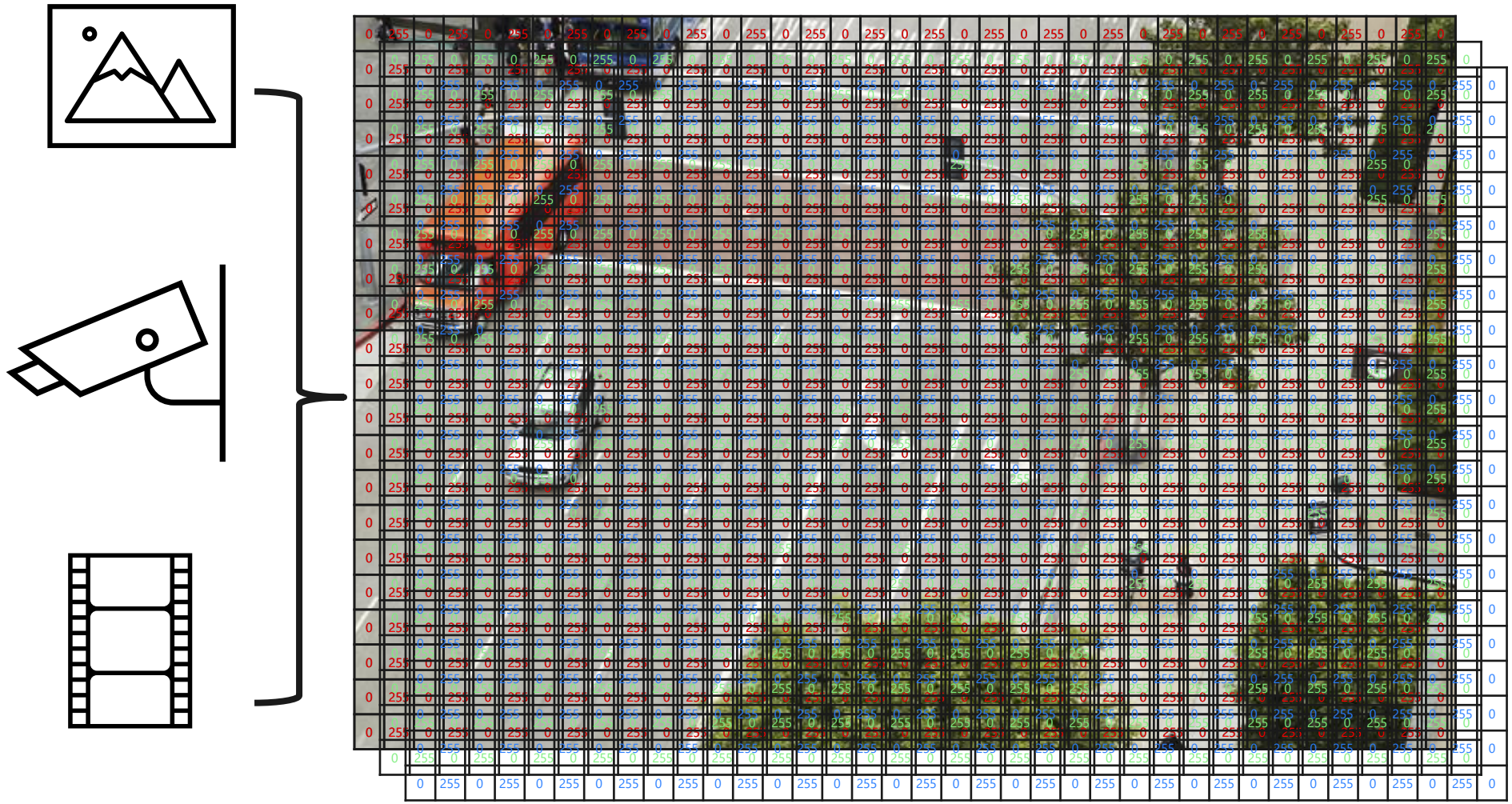


Module 3:

Explore Fundamentals of Computer Vision

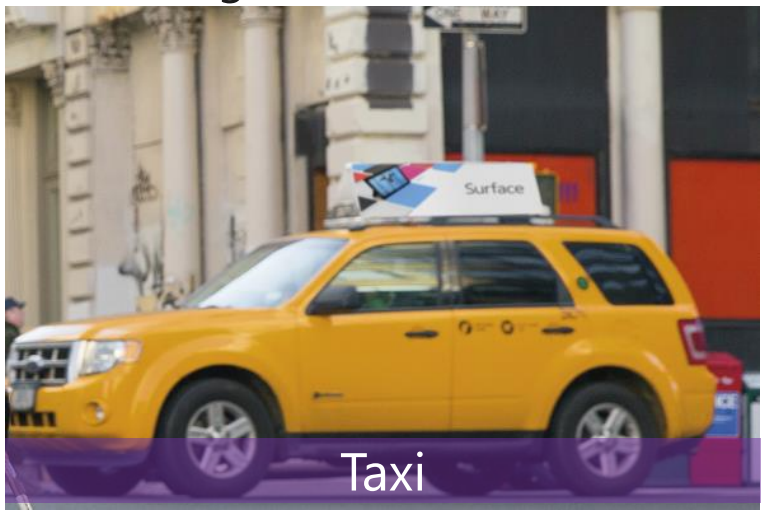
- Lesson 1: Computer Vision concepts
- Lesson 2: Creating Computer Vision solutions in Azure

What is Computer Vision?

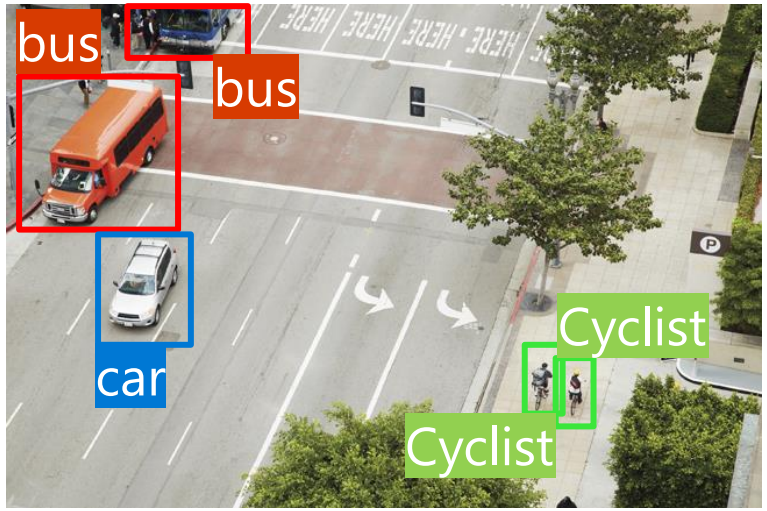


Applications of Computer Vision

Image Classification



Object Detection



Semantic Segmentation

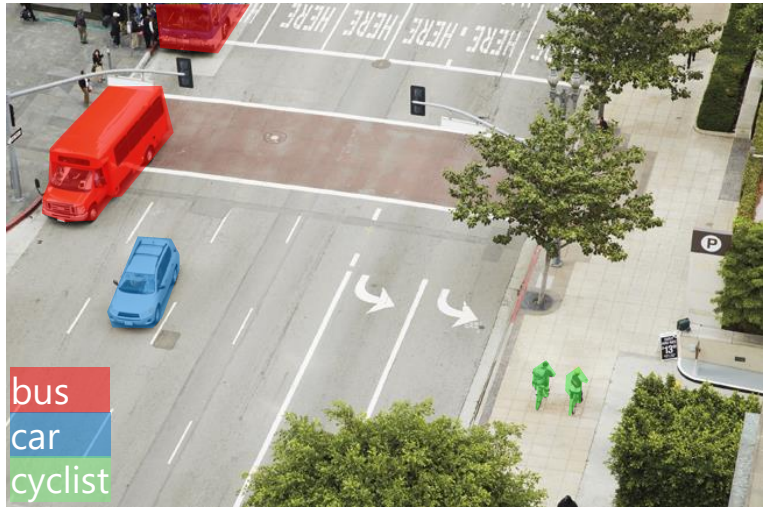
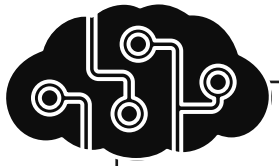


Image Analysis

Face Detection & Recognition

Optical Character Recognition

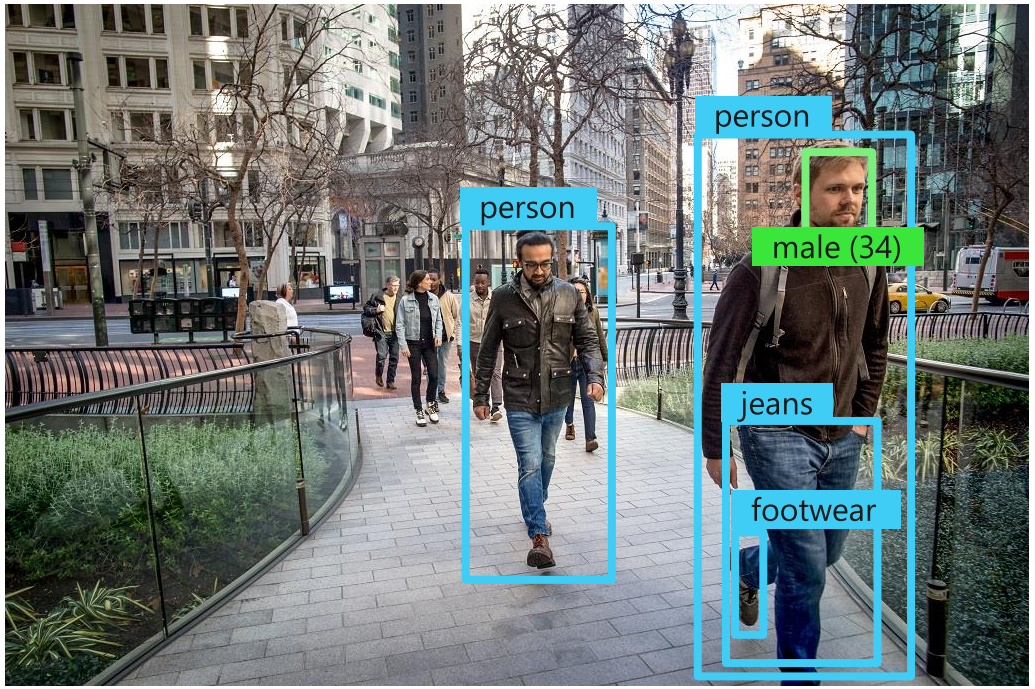
Computer Vision Services in Azure



Computer Vision	• Image analysis – automated captioning and tagging • Common object detection • Face detection • Smart cropping • Optical character recognition
Custom Vision	• Custom image classification • Custom object detection
Face	• Face detection and analysis
Form Recognizer	• Data extraction from forms, invoices, and other documents

Image Analysis with the *Computer Vision* Service

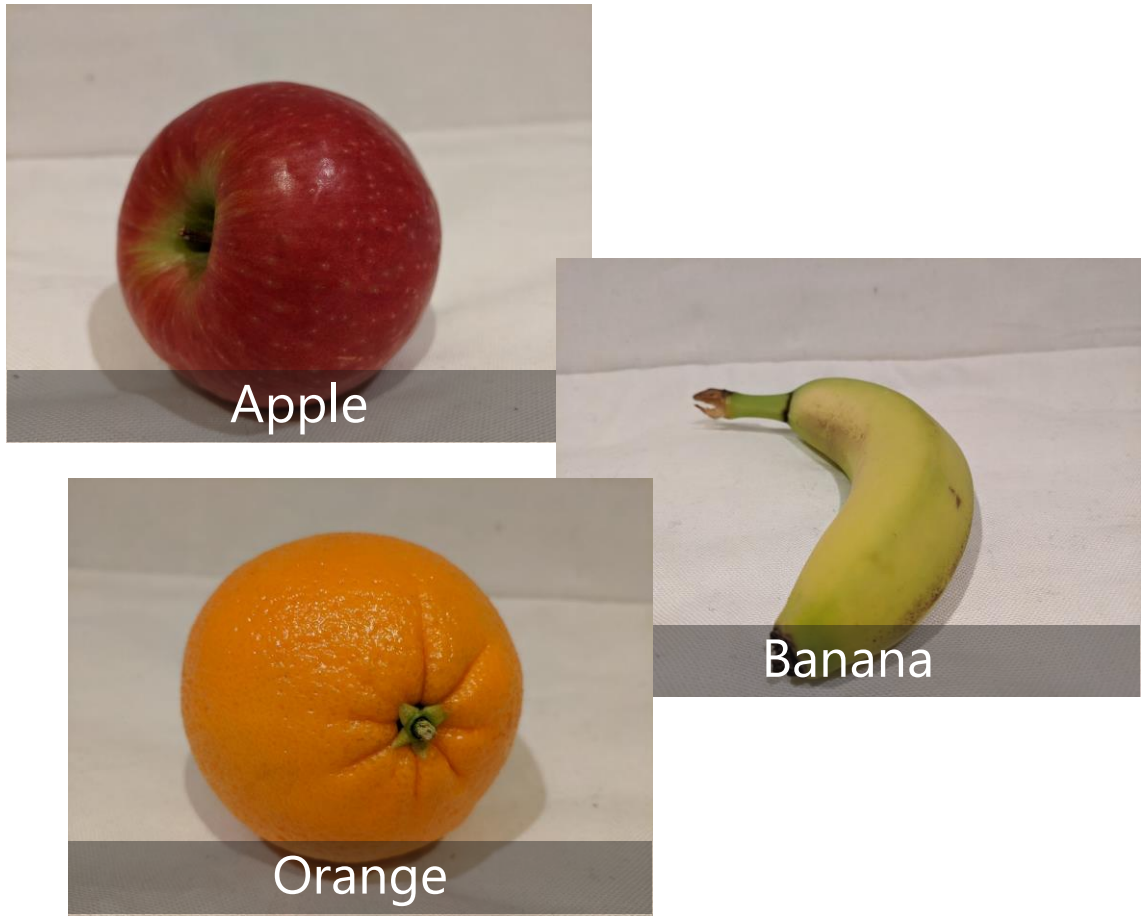
- Pre-trained computer vision model
- Object detection for over 10,000 predefined classes
- Image description and tag generation
- Face detection and analysis
- Content moderation
- Text detection and OCR



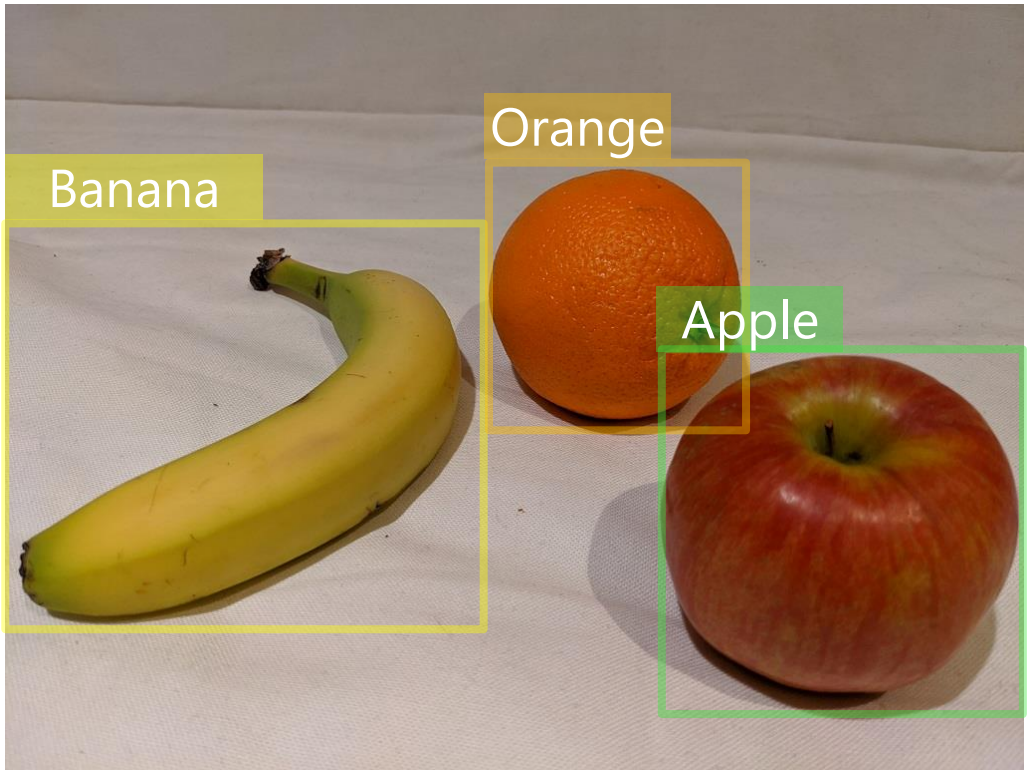
Caption: a group of people walking on a sidewalk
Tags: building, jeans, street, outdoor, jacket, city, person
Ratings: *Adult*: False, *Racy*: False, *Gore*: False

Training Models with the *Custom Vision* Service

Image Classification



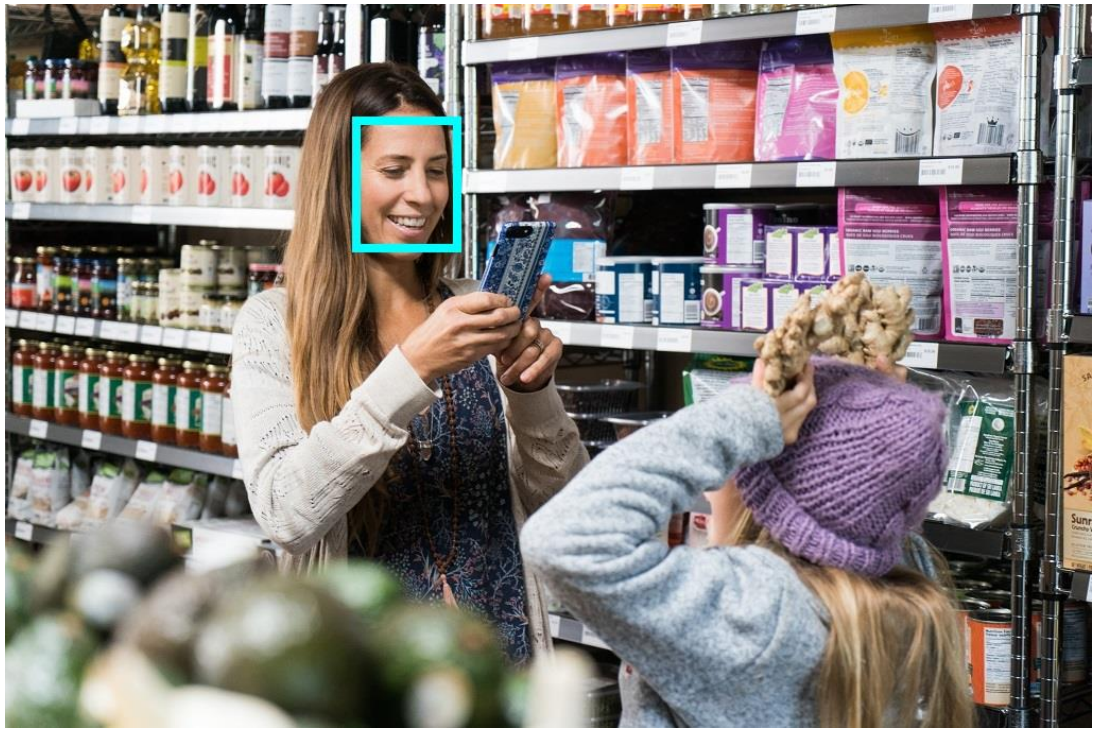
Object Detection



Detecting Faces with the *Face* Service

Anyone can use the Face service to detect:

- Blur
- Exposure
- Glasses
- Head pose
- Noise
- Occlusion



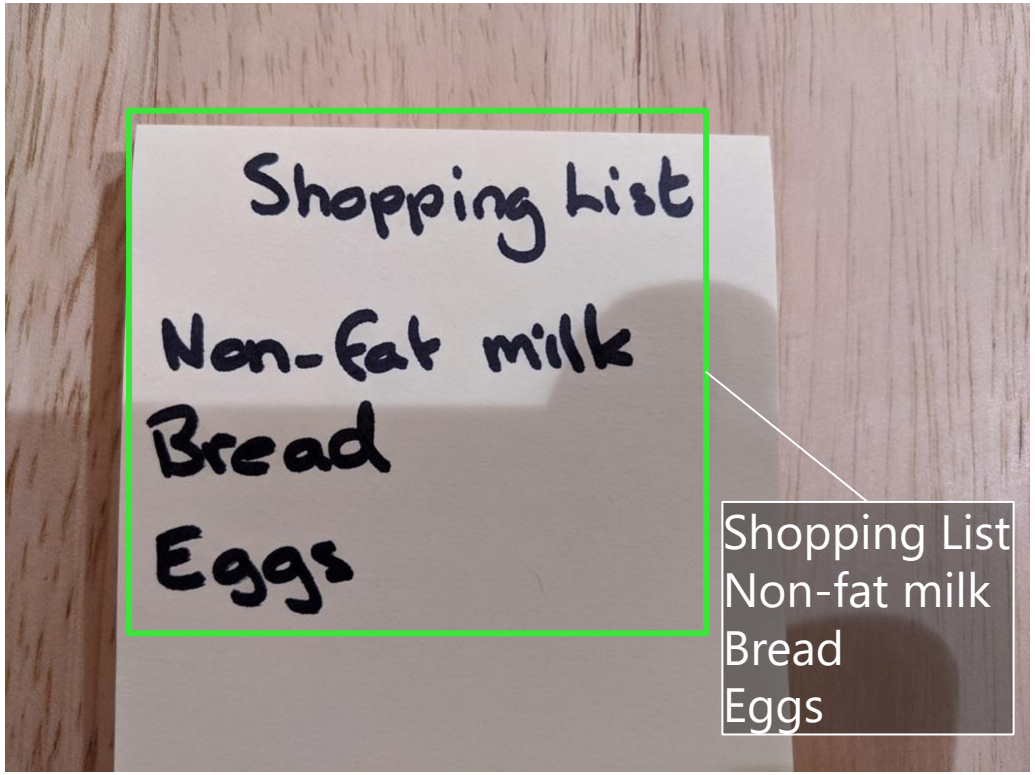
Only Managed Microsoft customers can access facial recognition capabilities:

- Similarity matching
- Identity verification

*To support Microsoft's Responsible AI Principles, Facial Recognition is under a Limited Access policy.

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
  - Use the pre-trained models for common document types
  - Train a custom model using your own forms
- Models perform *semantic recognition* of form fields – not just text extraction

Module 4:

Explore Fundamentals of Natural Language Processing

- Lesson 1: Introduction to natural language processing
- Lesson 2: Building natural language solutions in Azure

What is Natural Language Processing?

Text analysis and entity recognition

Sentiment analysis

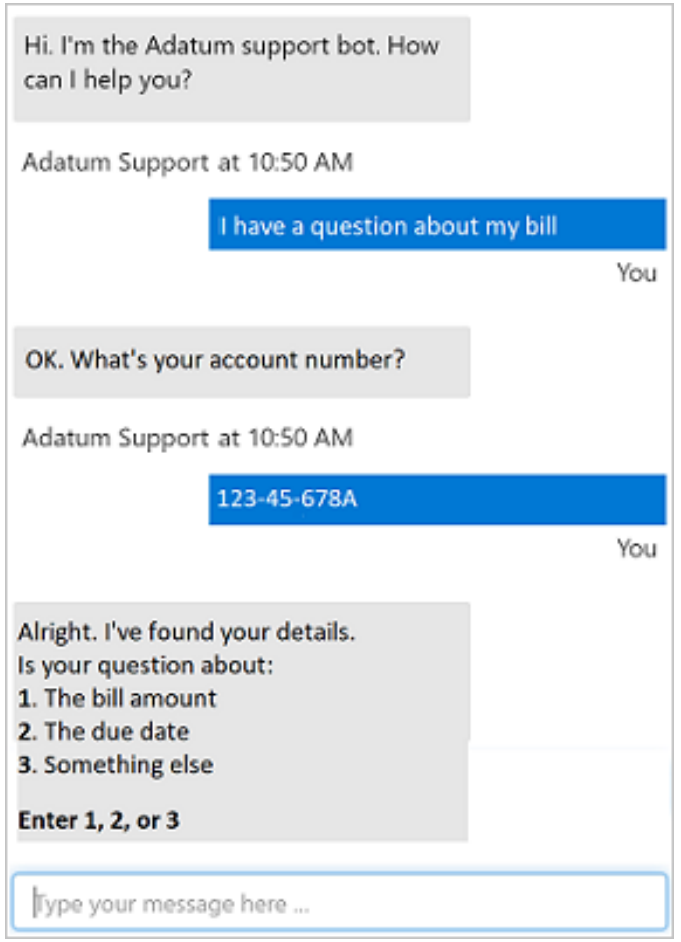
Speech recognition and synthesis

Machine translation

Semantic language modeling

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



Natural Language Processing and Conversational AI in Azure

Language	• Language detection • Key phrase extraction • Entity detection • Sentiment analysis • Question answering • Conversational language understanding
Speech	• Text to speech • Speech to text • Speech translation
Translator	• Text translation
Azure Bot Service	• Platform for conversational AI

Analyzing Text

I had a wonderful vacation in France.

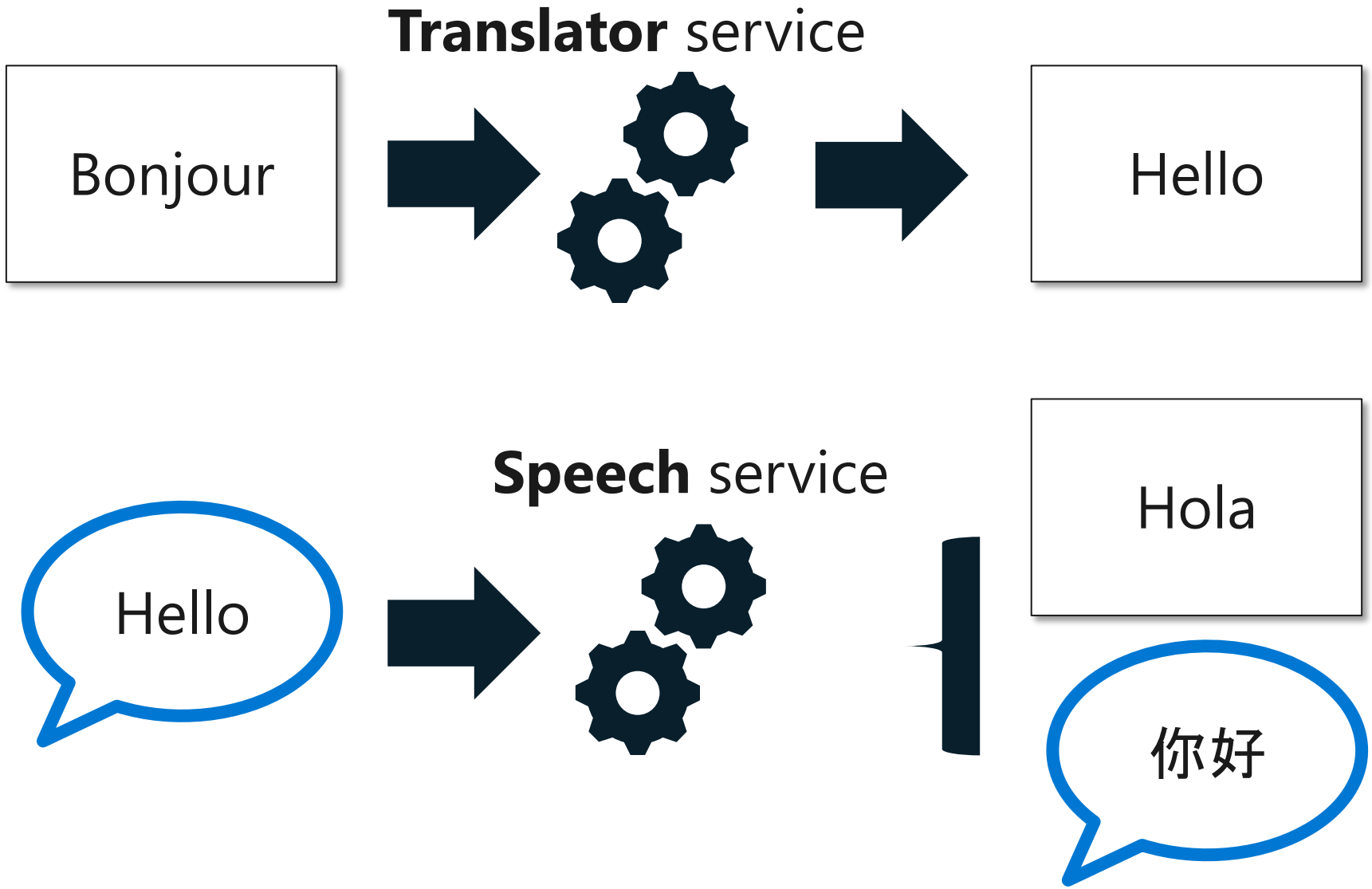
- Predominant Language: English
- Sentiment: 88% (positive)
- Key Phrases: "wonderful vacation"
- Entities: France

Speech Recognition and Synthesis

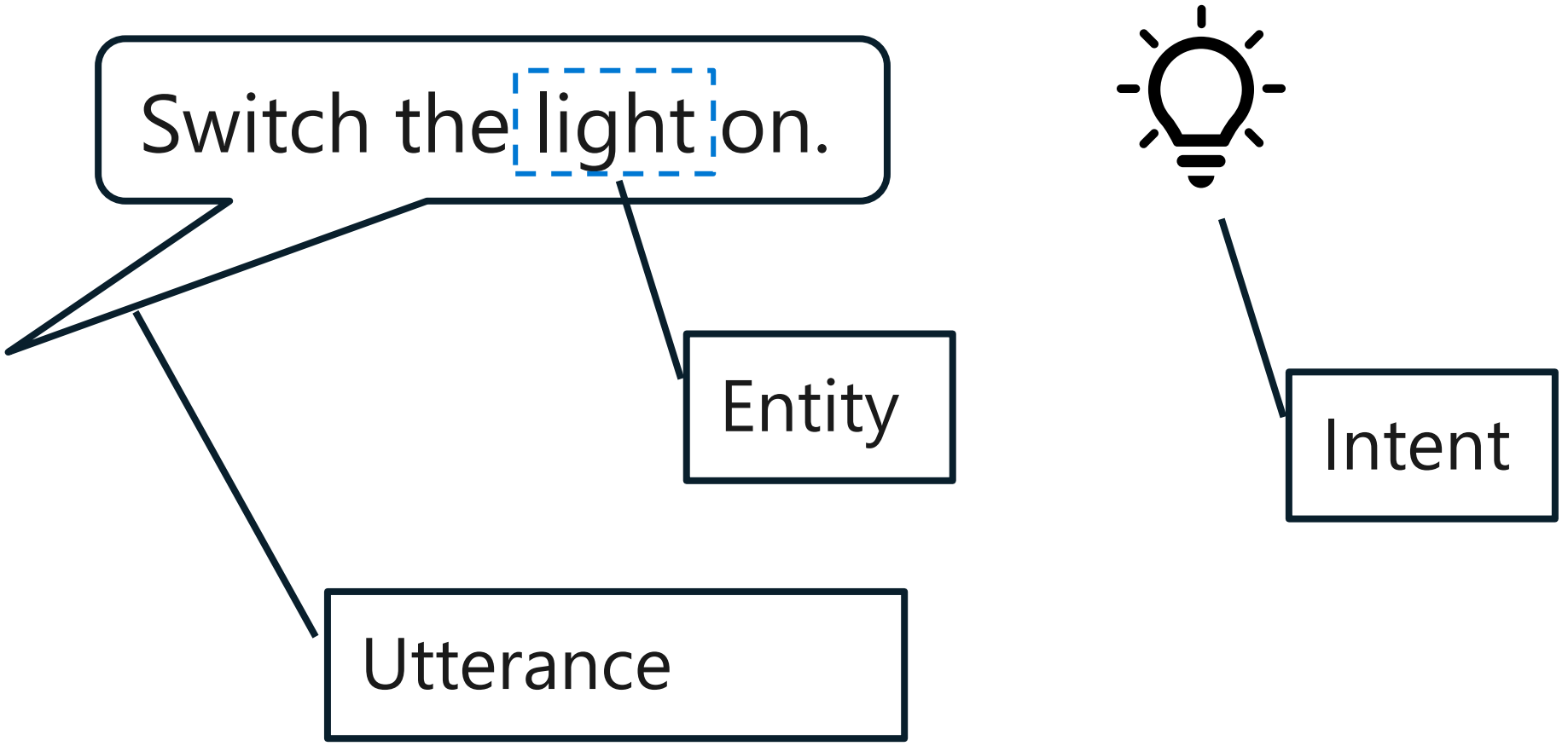
Use the *speech-to-text* capabilities of the **Speech** service to transcribe audible speech to text

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

Translation

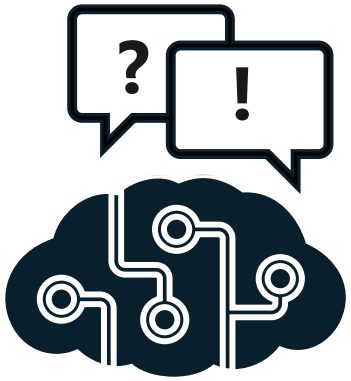


Conversational Language Understanding

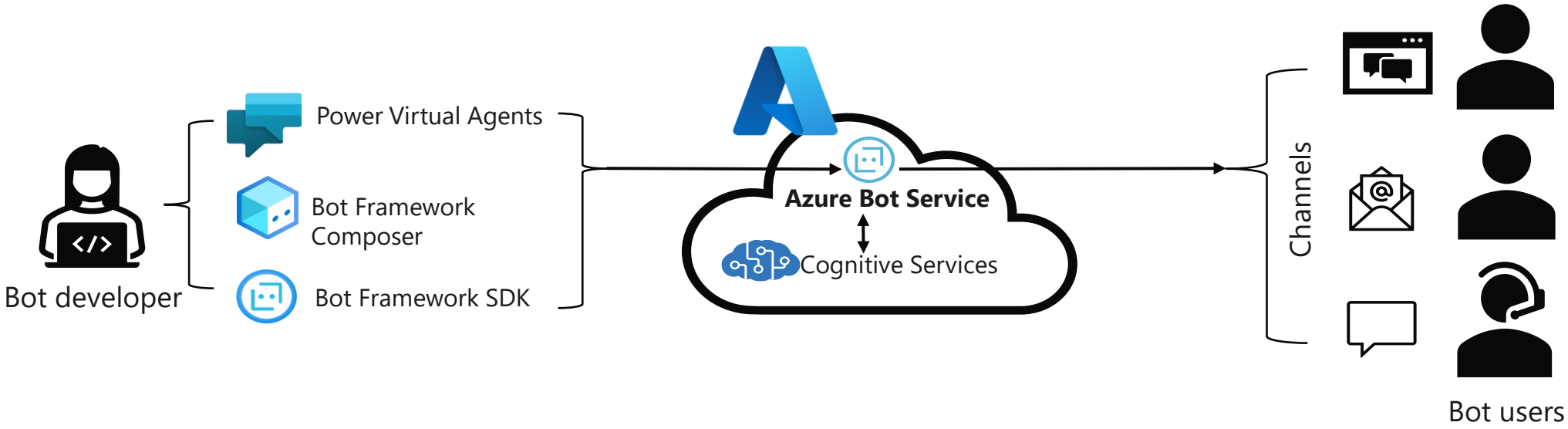


Question Answering

- 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*
- The knowledge base is consumed by client applications and bots



Azure Bot Service



Create bots using multiple tools:

- Power Virtual Agents
- Bot Framework Composer
- Bot Framework SDK

Use the Azure Bot Service to publish bots in the cloud and Integrate with cognitive services

Users interact with bots through multiple channels such as:

- Web chat
- Email
- Telephone