Microsoft

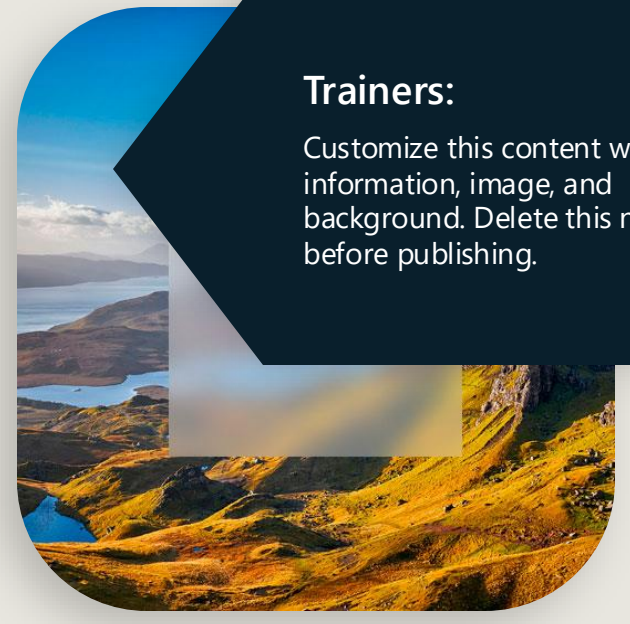
AI-102: Designing and Implementing a Microsoft Azure AI Solution

Introduction

Date

Hello!

Thank you for joining me today



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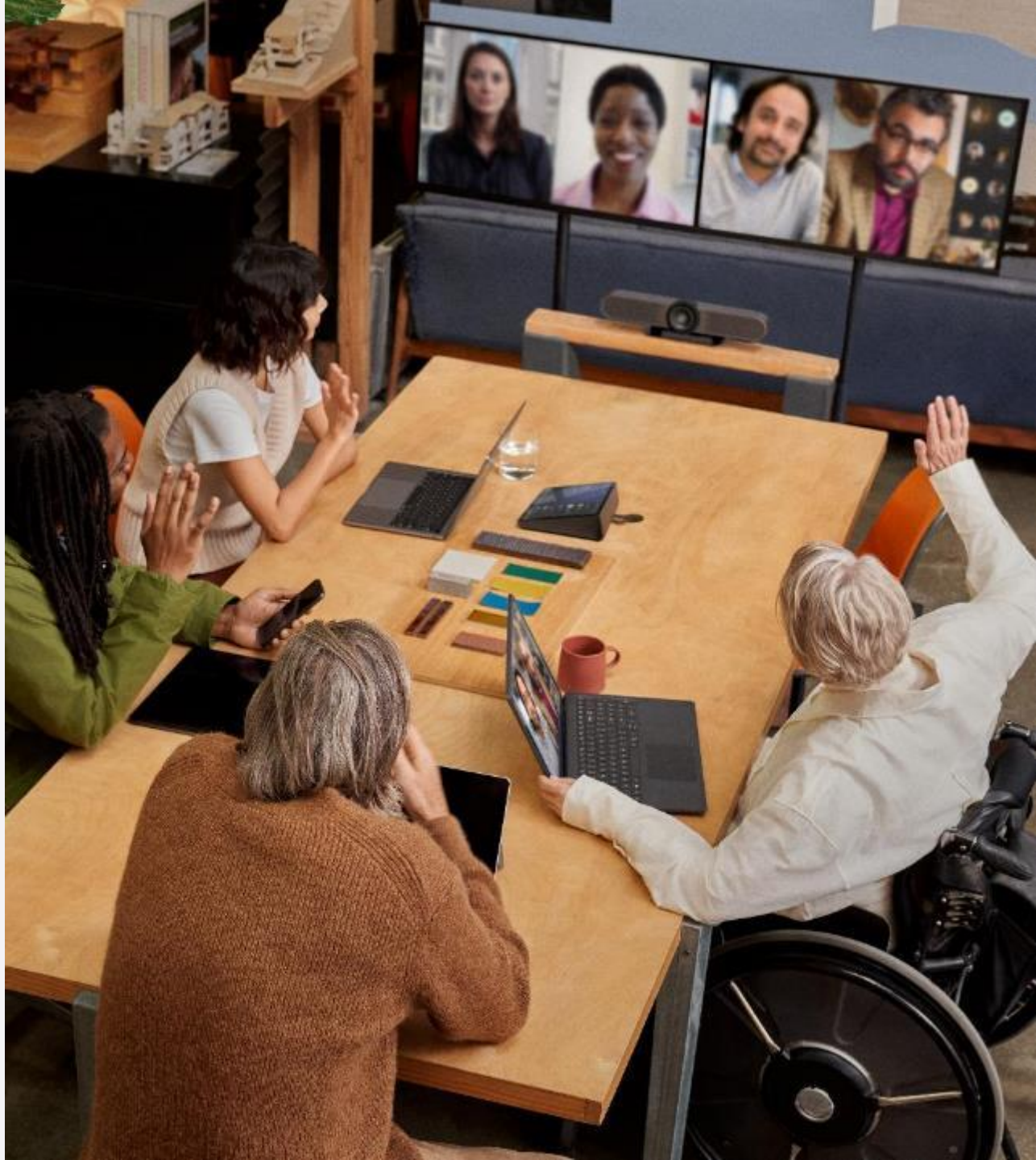
Your expectations for the course



About this course

What we'll cover

In this course, you will learn how to develop solution using Azure AI Services. Topics covered include natural language understanding, computer vision, document intelligence and generative AI. Specifically, you'll learn how to:

- Provision Azure resources and use the service studios
- Train and customize various Azure AI models
- Use APIs and SDKs to consume models from client applications

Intended audience

The primary audience for this course is application developers seeking to include Azure AI functionality in their applications.

Although most Azure AI services can be used with web studios, to use the APIs and SDKs effectively, a basic knowledge of Microsoft C# or Python is recommended.

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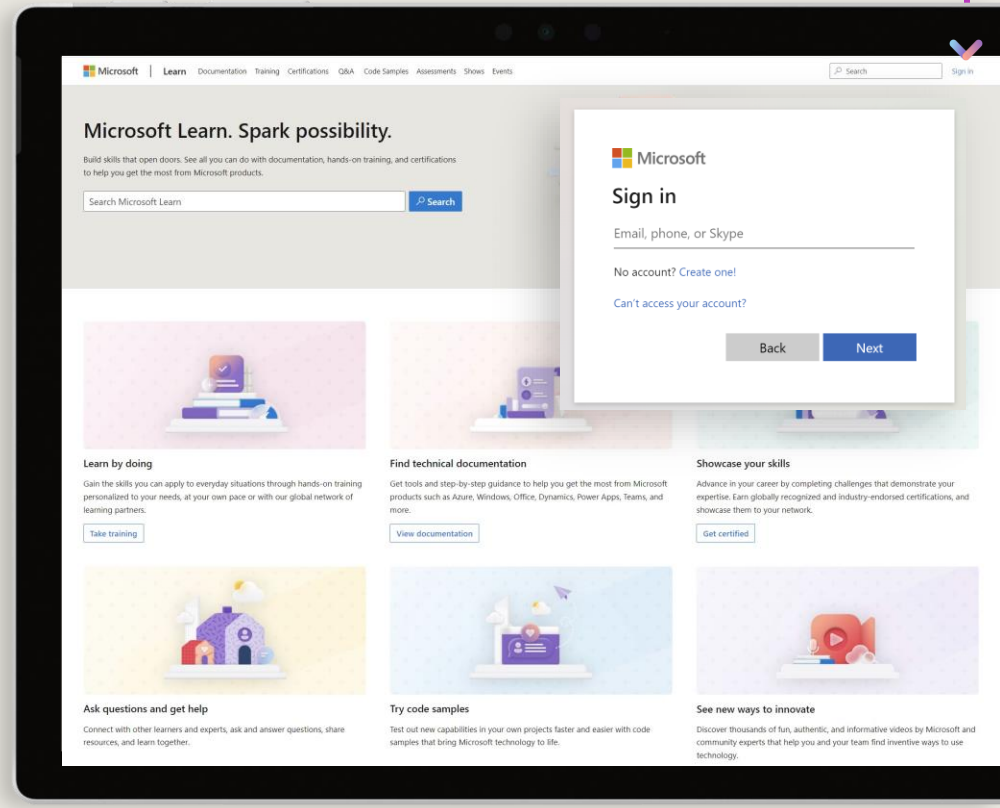
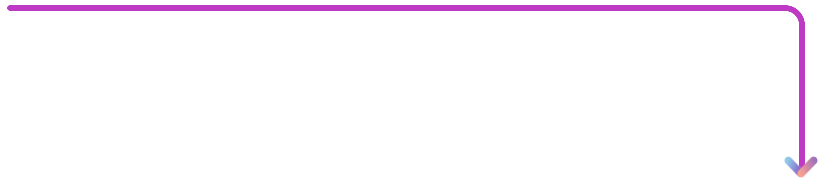


Access your course material

All course content is available on Microsoft Learn

learn.microsoft.com/training/courses/browse

- We'll go through this content together and as the course progresses, I will advise you on which modules to review.
- You can provide feedback for modules on Microsoft Learn. Find how at the bottom of each page.



Need help? See our troubleshooting guide or provide specific feedback by reporting an issue.

This course includes labs:

- Detailed lab instructions are included in your lab environment.
- Each exercise is standalone and requires:
  - A Microsoft Azure subscription
  - For Azure OpenAI exercises, approved access to the Azure OpenAI service. Request throug the form at aka.ms/oaiapply

https://aka.ms/azure-ai-credential

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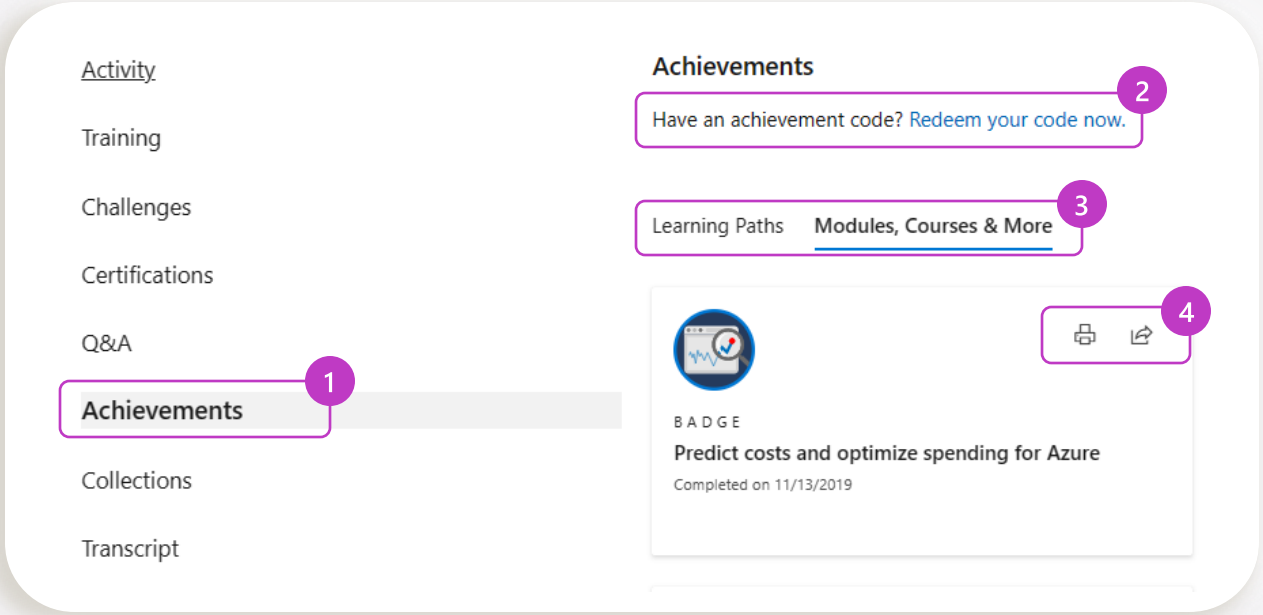

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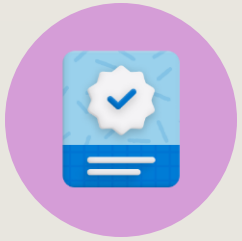

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[1] "2023 Value of IT Certification | Candidate Report," Pearson VUE, 2023 [2] Microsoft fundamentals certifications don't expire

Get ready for your Microsoft Certification exam

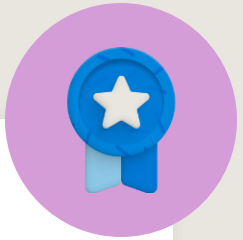
Exam AI-102: Designing and Implementing a Microsoft Azure AI Solution covers the features and capabilities of Microsoft Azure AI Services, including Azure OpenAI Service

Understand the skills measured by the exam

Study area	Percentage
Plan and manage an Azure AI solution	15–20%
Implement decision support solutions	10–15%
Implement computer vision solutions	15-20%
Implement natural language processing solutions	30–35%
Implement knowledge mining and document intelligence solutions	10–15%
Implement generative AI solutions	10-15%

Percentages indicate the relative weight of each area on the exam
The higher the percentage, the more questions you are likely to see in that area

Build confidence in your skills



Find in the exam page resources to help prepare

- Watch exam prep videos
- Review the exam study guide
- Demo the exam experience with the exam sandbox
- Take a practice assessment

Microsoft

Introduction to AI and AI on Azure

Agenda

- Introduction to AI
- AI on Azure
- Get started with Azure AI services
- Using Azure AI Services for enterprise applications

Introduction to AI and Azure AI services

Learning Objectives

After completing this module, you will be able to:

1. Describe artificial intelligence and how it compares to machine learning and data science.

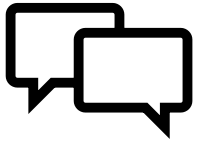
2. Describe Azure AI services.

What is Artificial Intelligence?

Software that exhibits human-like capabilities, such as:

Visual Perception

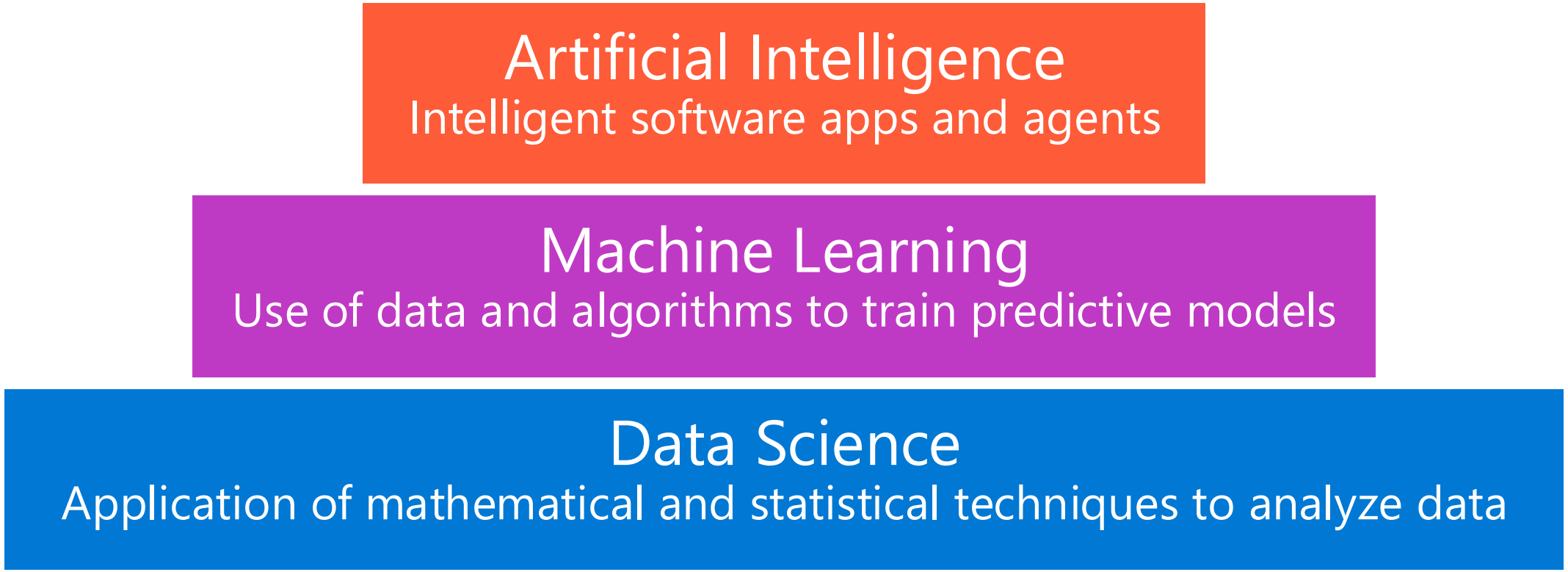
Text Analysis



Conversation

Decision Making

Data Science, Machine Learning, and AI



AI for Software Engineers

Software Development Skills

- Coding (C#, Python, Node.js, …)
- Consuming APIs (REST or SDKs)
- DevOps (source control, CI/CD)

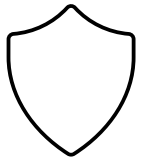
Conceptual AI Understanding

- Model training and inferencing
- Probability and confidence scores
- Responsible AI and ethics

Considerations for Responsible AI

Fairness

Reliability & Safety



Privacy & Security

Inclusiveness

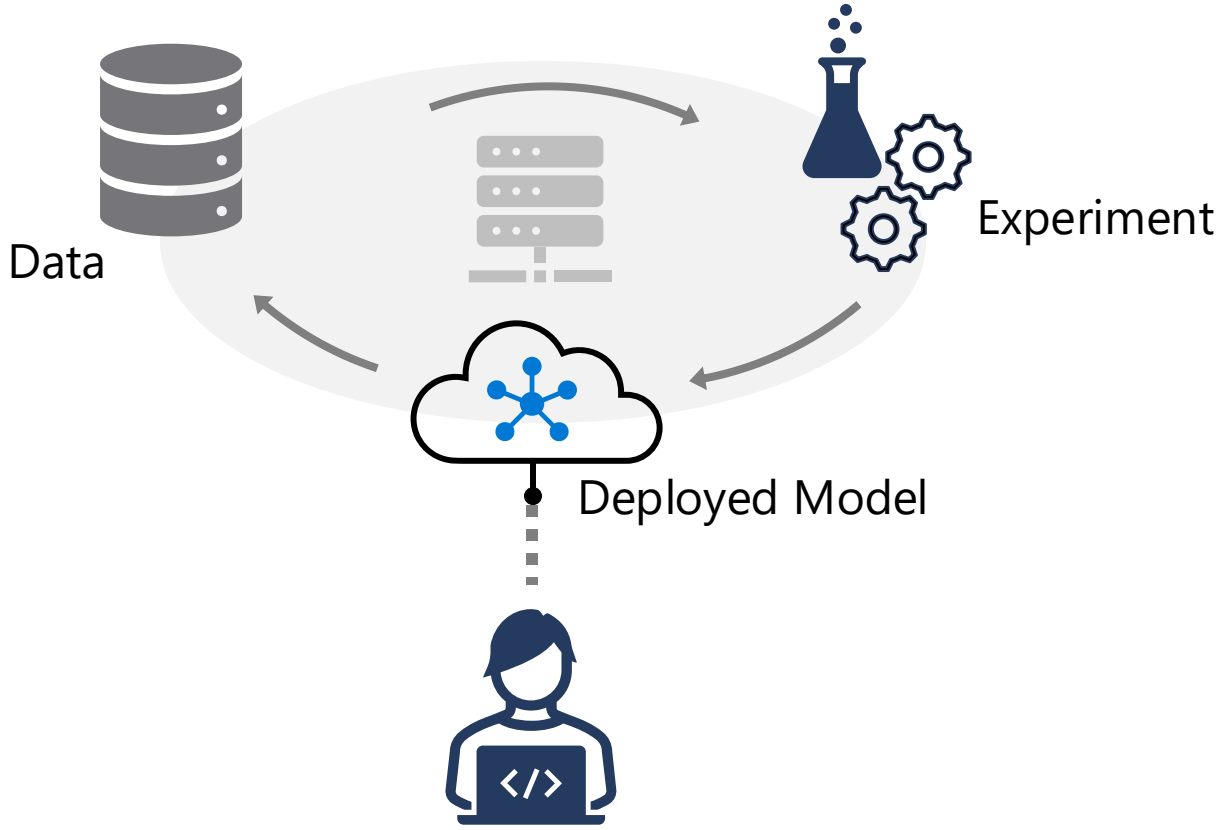
Transparency

Accountability

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

Azure Machine Learning

Cloud platform for creating and operating machine learning solutions

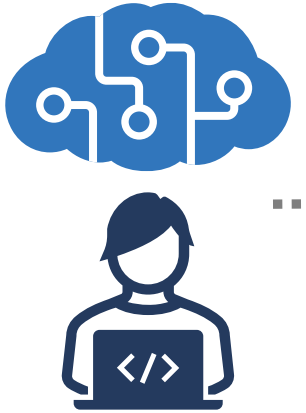


Azure AI Services

Prepackaged AI services you can integrate into solutions

Capabilities include:

Language	Speech	Vision	Generative
• Text analysis • Question answering • Language understanding • Translation	• Speech recognition • Speech synthesis • Speech Translation • Speaker Recognition	• Image and video analysis • Image classification • Object detection • Optical character recognition	• Generate text completions • Image generation

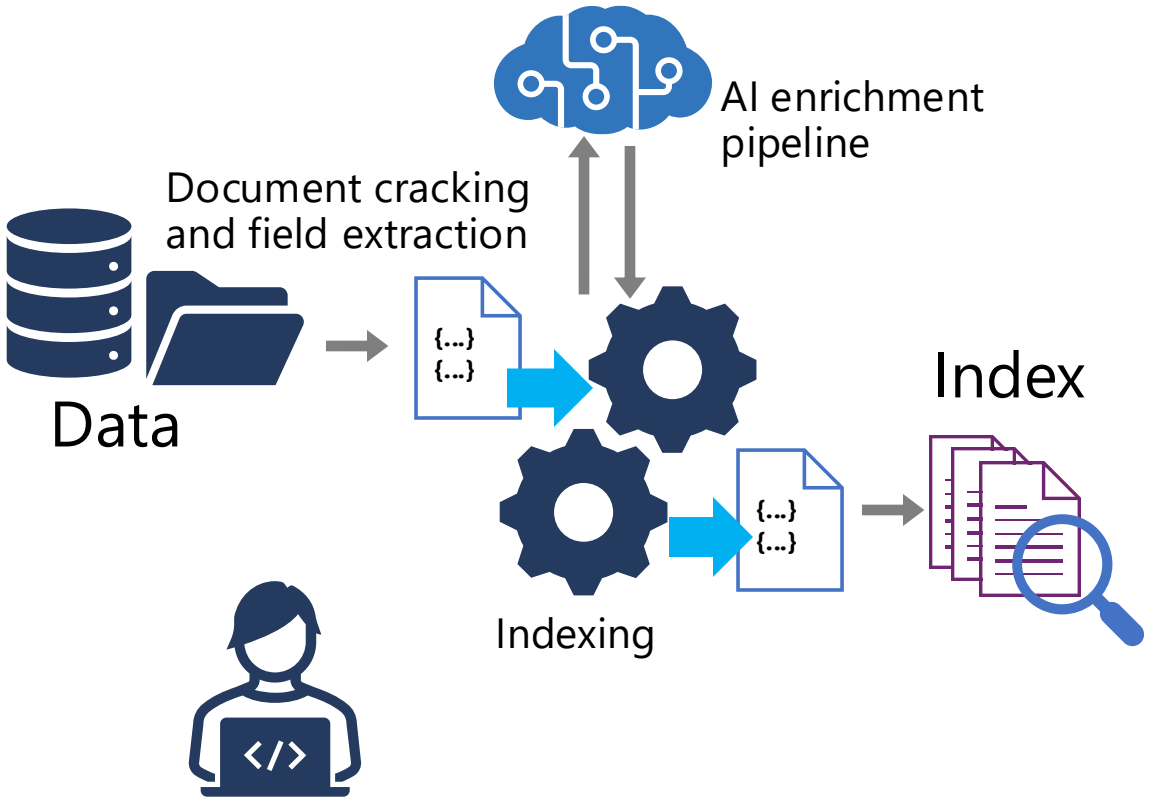


Azure AI Services

- Azure AI Document Intelligence
- Azure AI Language
- Azure AI Vision
- Azure OpenAI
- Azure AI Search

Azure AI Search

AI-enriched indexing for search and knowledge mining



Knowledge check

1 **Which of the following best describes the predictions made by a machine learning model?**

- ☐ Absolutely correct values based on conditional logic.
- ☐ Randomly selected values with an equal chance of selection.
- ☑ Probabilistic values based on correlations found in training data.

2 **A data scientist has used Azure Machine Learning to train a machine learning model. How can you use the model in your application?**

- ☑ Use Azure Machine Learning to publish the model as a web service.
- ☐ Export the model as an Azure AI service.
- ☐ You must build your application using the Azure Machine Learning designer.

3 **You want to index a collection of text documents, and search them from a mobile application. Which service should you use to create the index.**

- ☐ Azure AI Language
- ☑ Azure AI Search
- ☐ Azure AI Speech

Get Started with Azure AI services

Learning Objectives

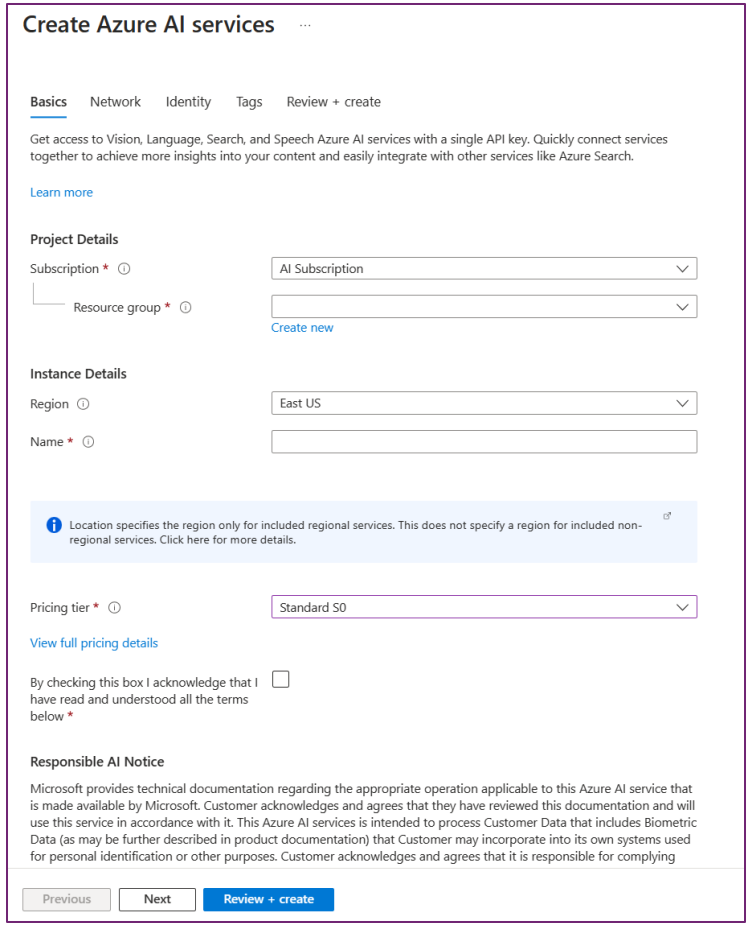
After completing this module, you will be able to:

1. Understand Azure AI APIs.
2. Create and consume Azure AI services resources.

Provisioning Azure AI Services resources

Create a resource in your Azure subscription

- You will create either a *single-service* resource or a *multi-service* resource:
- Multi-service resource **(Azure AI Services):**
  - Access multiple Azure AI Services with a single key and endpoint.
  - Consolidates billing from the services you use.
- Single-service resource (for example, **Language):**
  - Access a single Azure AI service with a unique key and endpoint for each service created.
  - Use the free tier to try out the service.



Endpoints, Keys, and Locations

Information required to connect

Endpoint:

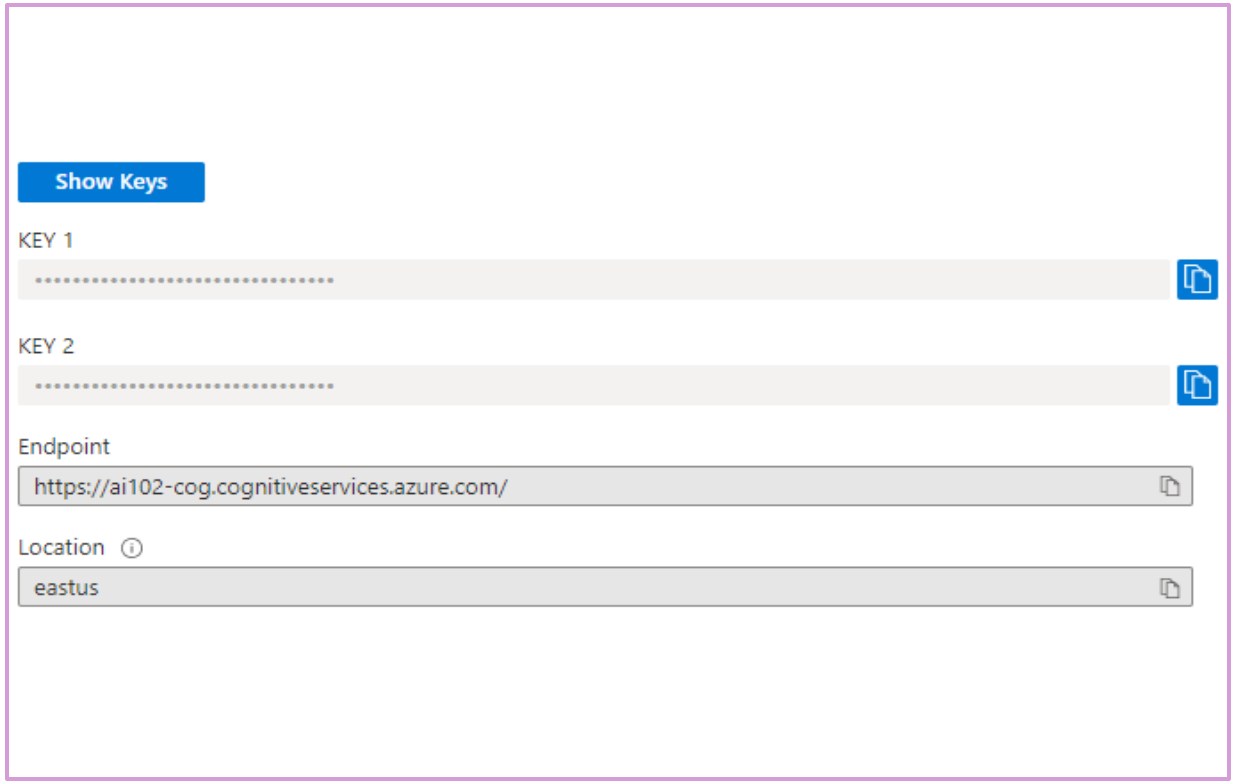
- URL at which service can be consumed
- Required by *most* SDK clients

Keys:

- Use *either* key to authenticate

Location:

- Azure data center in which resource is provisioned
- Required by *some* SDK clients

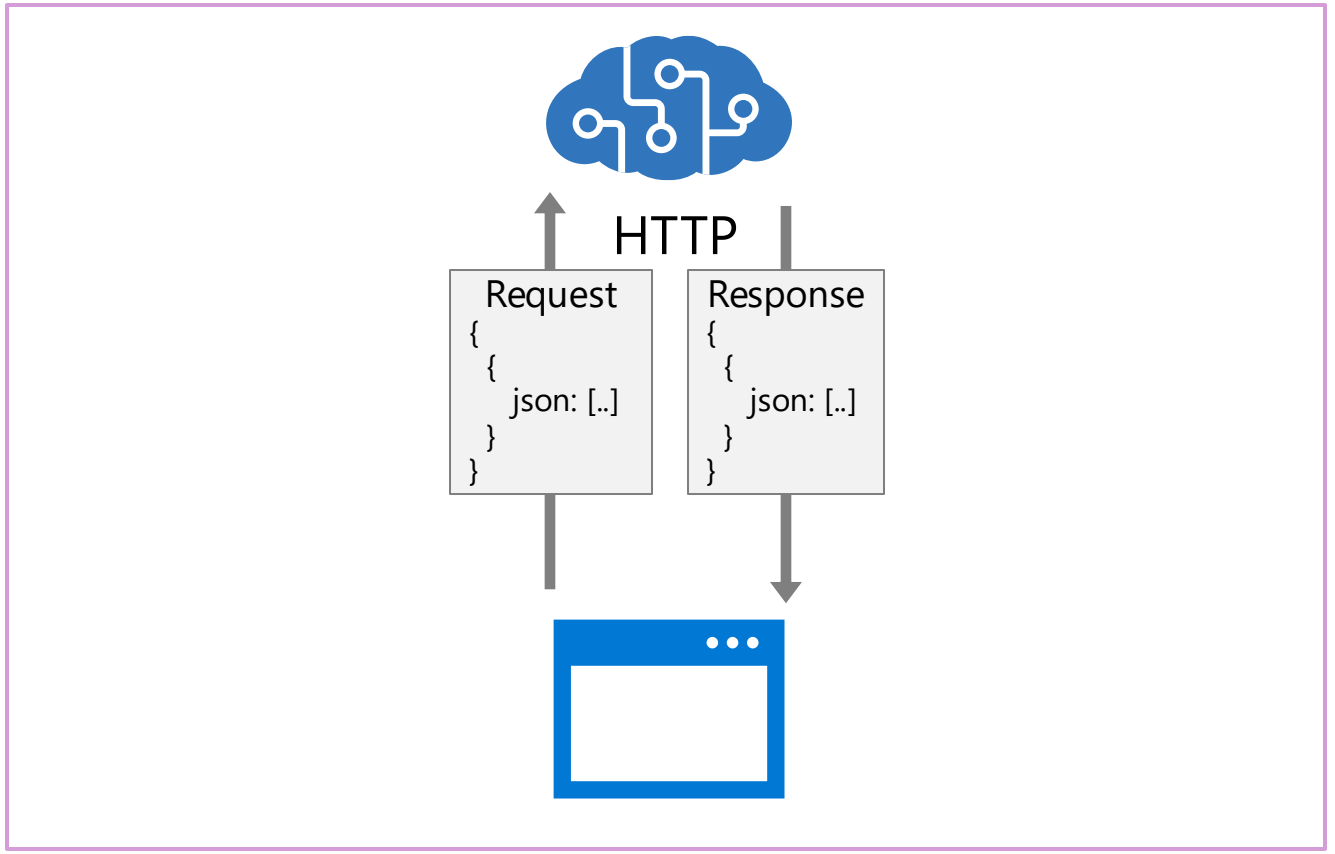


Azure AI Services REST APIs

Clients submit HTTP requests to the resource endpoint

- Key specified in request header
- Input data in JSON format
- Specific schema varies by service and method

Service returns JSON response

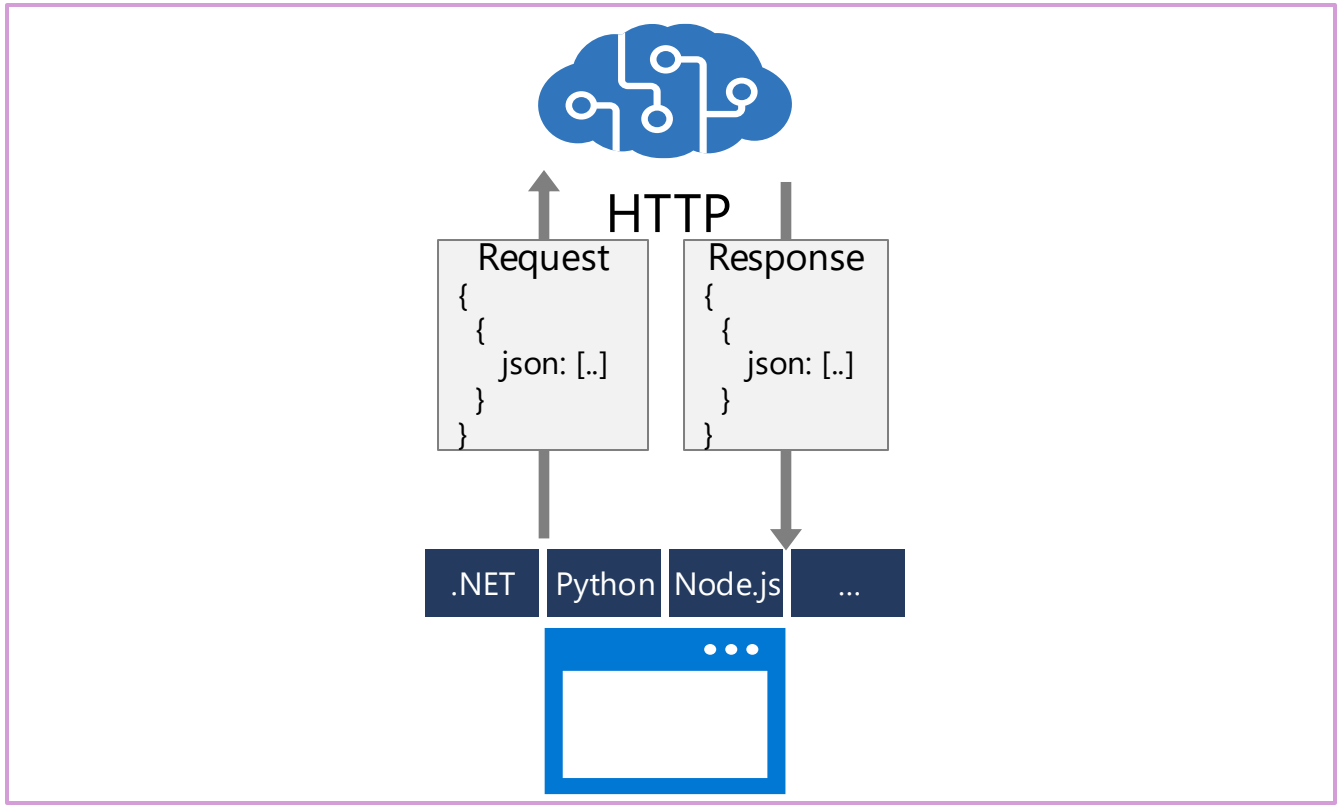


Azure AI Services SDKs

Runtime library abstracts REST interface

Multiple SDKs for each service:

- .NET
- Python
- Node.js
- Java
- Others…



Exercise – Get Started with Azure AI Services

Provision an Azure AI Services resource

Use a REST interface

Use an SDK

Using Azure AI Services for enterprise applications

Learning Objectives

After completing this module, you will be able to:

1. Consider and manage authentication and network security for Azure AI services.
2. Manage costs, view metrics, and manage alerts and diagnostic logging.
3. Deploy to secure containers and consume Azure AI services from containers.

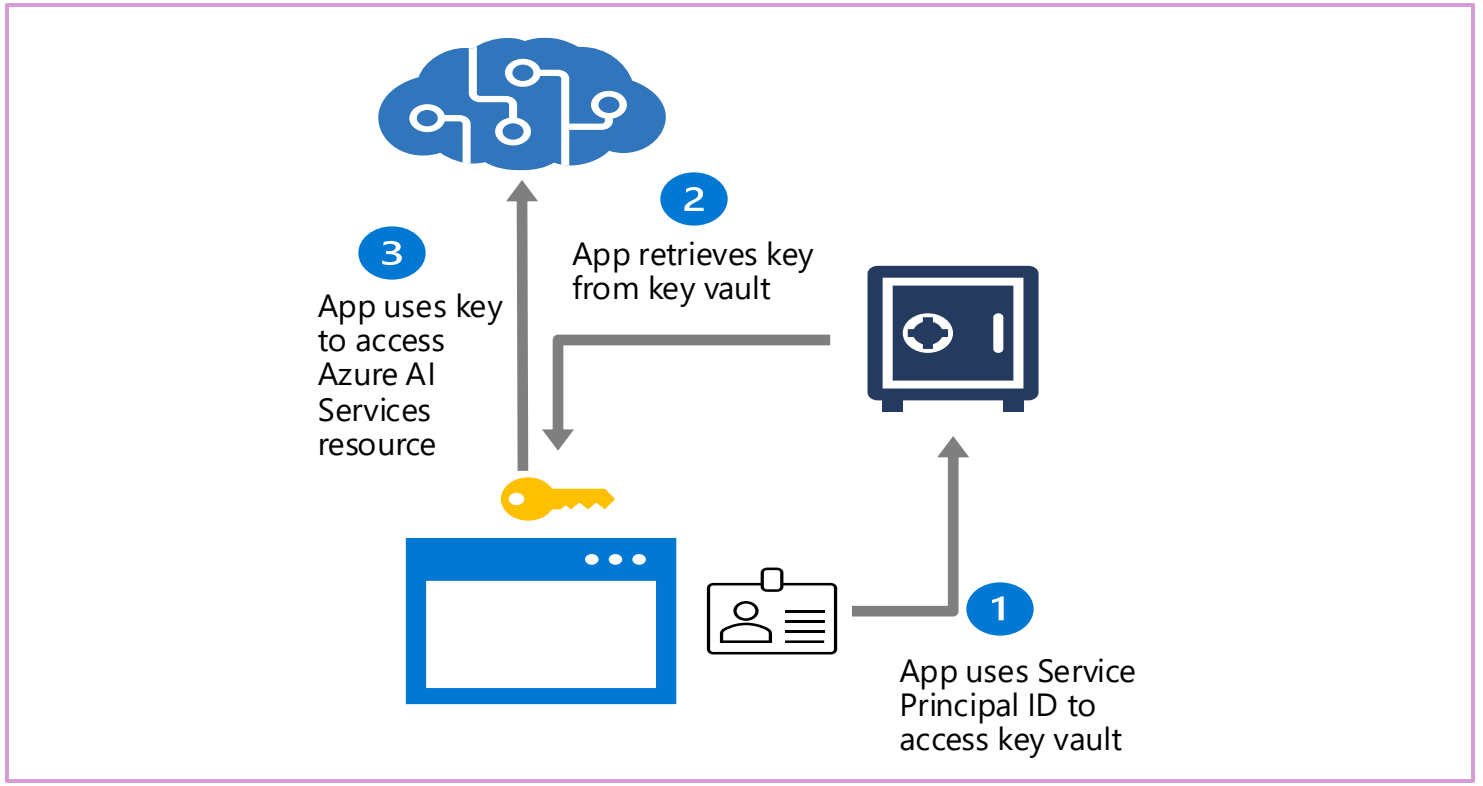
Considerations for Azure AI Services security

Regenerate keys regularly to protect access

- To avoid service interruption, switch apps to use key 2 before regenerating key 1; and vice-versa

Consider protecting keys by storing them in Azure Key Vault

- Apps can use a Service Principal as a managed identity to retrieve keys from Key Vault



Demo – Manage Azure AI Services security

Manage Authorization Keys

Secure Key Access with Azure KeyVault

Monitoring Azure AI Services Activity

Alerts

- Alerts will ensure that the correct team knows when a problem arises.
- Every alert or notification available in Azure Monitor is the product of a rule

Metrics

- Metrics are numerical values
- The metrics are collected at regular intervals and are useful for alerting.
- Metrics are stored in a time-series database.

Diagnostic settings

- Configure diagnostic settings is to provide detailed information for diagnostics and auditing.
- Diagnostic Destinations:
  - Log Analytics Workspace
  - Event Hubs
  - Azure Storage

Logs

- Logs contain time-stamped information about changes made to resources.
- The log data is organized into record
- The logs can include numeric values, but most include text data
- The most common type of log entry records an event

Demo – Monitor Azure AI Services

Configure an alert

Visualize a metric

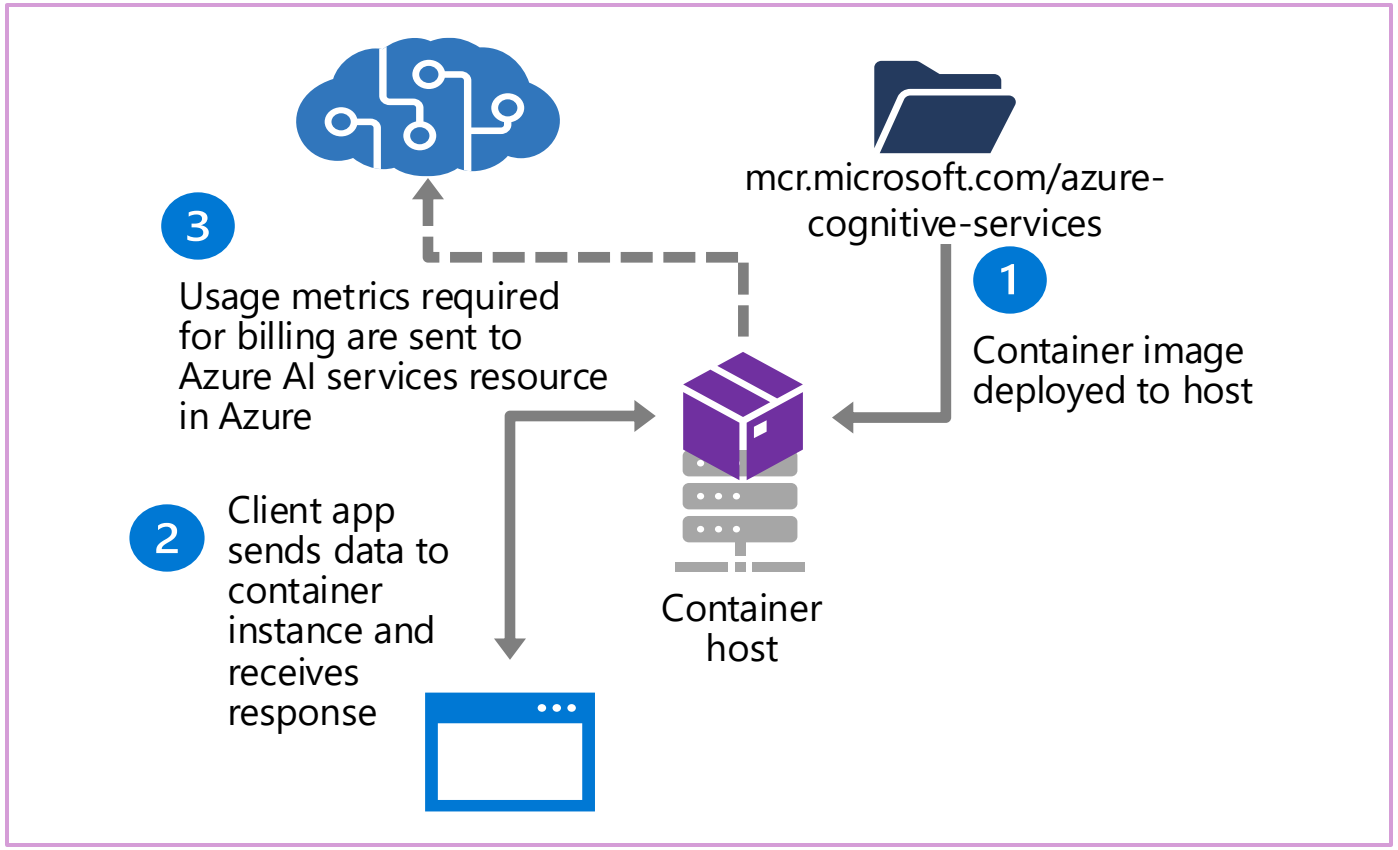
Azure AI Services and Containers

Container images are available for commonly used Azure AI services APIs

- Deploy containers to:
- Local Docker hosts
- Azure Container Instances
- Azure Kubernetes Services clusters
- others…

Enables more control over data sent to public Azure AI service endpoint

- An Azure AI services resource is still required, and the container must communicate with it to send billing data



Extended interactive exercises – Use an Azure AI Services container

https://aka.ms/ai-services-lp

Knowledge check

1 **How are client applications typically granted access to an Azure AI services endpoint?**

- ☑ The application must specify a valid subscription key for the Azure resource.
- ☐ The user of the application must enter a user name and password associated with the Azure subscription.
- ☐ Access to Azure AI services is granted to anonymous users by default.

2 **You want to keep track of how often the subscription keys for your Azure AI services resource are retrieved. What should you do?**

- ☐ Regenerate the keys for your Azure AI services resource.
- ☑ Create an alert for your Azure AI services resource.
- ☐ Store the keys in Azure Key Vault.

3 **You plan to use an Azure AI services container in a local Docker host. Which of the following is true?**

- ☐ Client applications must pass a subscription key to the Azure resource endpoint before using the container.
- ☐ All data passed from the client application to the container is forwarded to the Azure resource endpoint.
- ☑ The container must be able to connect to the Azure resource endpoint to send usage data for billing.

Learning Path Recap

In this learning path, we:

Described artificial intelligence and how it compares to machine learning and data science.

Described Azure AI services.

Understood how to get started with Azure AI services

Understood how to use Azure AI Services for enterprise applications

Microsoft

Develop natural language processing solutions

Agenda

- Analyzing and translating text

Analyzing text

Learning Objectives

After completing this module, you will be able to:

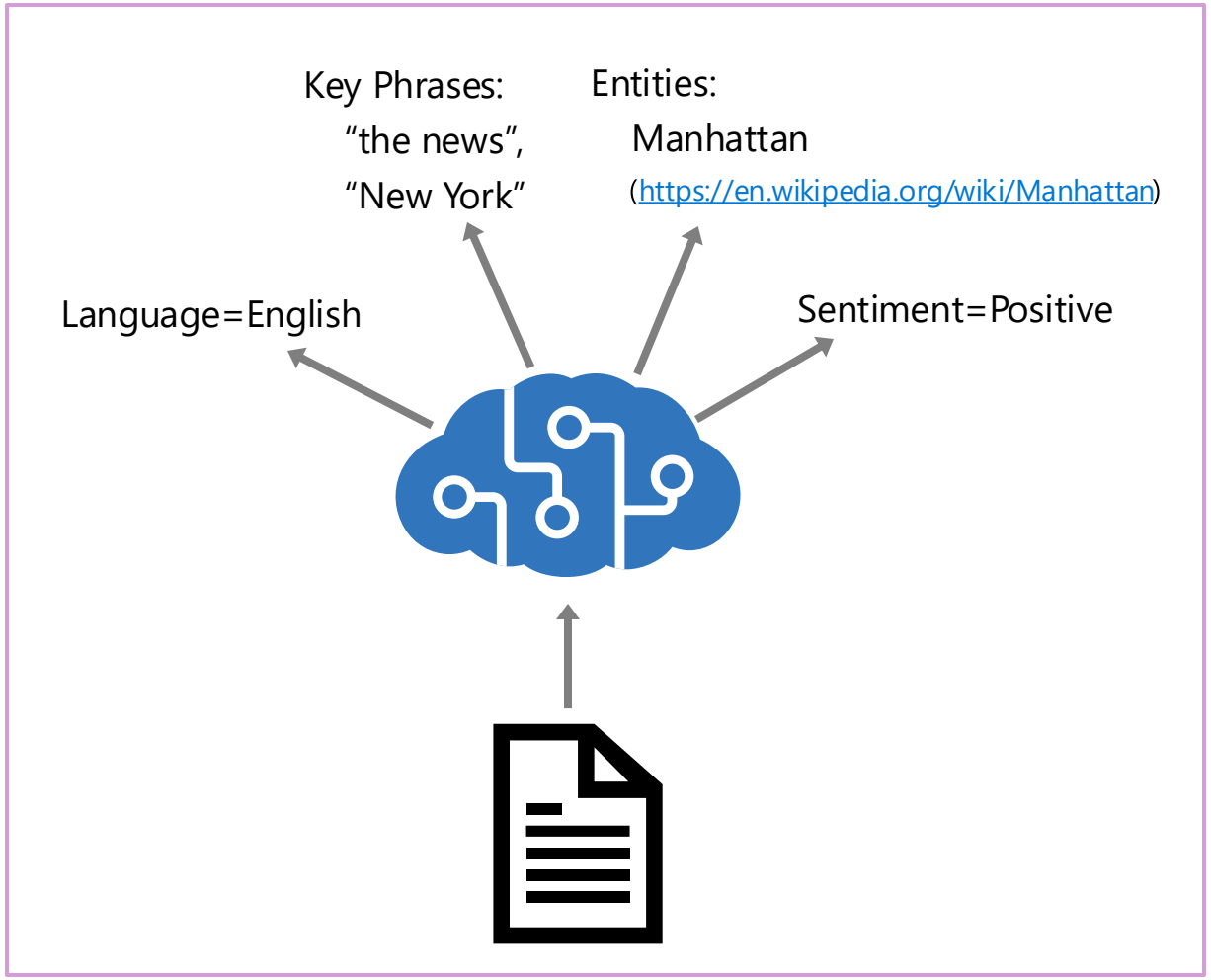
1. Detect language and extract key phrases
2. Analyze sentiment and detect PII
3. Summarize text
4. Extract entities and linked entities
5. Translate text

The Azure AI Language Service

Preconfigured features:

- Language detection
- Key phrase extraction
- Sentiment analysis
- Named entity recognition
- Entity linking
- Summarization
- PII detection

Customizable features are covered in another section



Language detection

- Determine the language in which text is written
- Often useful as a pre-cursor to further analysis that requires a known language

Collection of one or more text documents

Optional locale hint

String to be analyzed

```
{
  "documents": [
    {
      "countryHint": "US",
      "id": "1",
      "text": "Hello world"
    },
    {
      "id": "2",
      "text": "Bonjour tout le monde"
    }
  ]
}
```

```
{
  "documents": [
    {
      "id": "1",
      "detectedLanguage": {
        "name": "English",
        "iso6391Name": "en",
        "confidenceScore": 1
      },
      "warnings": []
    },
    {
      "id": "2",
      "detectedLanguage": {
        "name": "French",
        "iso6391Name": "fr",
        "confidenceScore": 1
      },
      "warnings": []
    }
  ],
  "errors": [],
  "modelVersion": "2022-10-01"
}
```

Language name (in English)

2-character language code

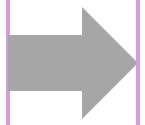
Prediction confidence (0 to 1)

Key phrase extraction

- Identify the main “talking points” of the text
- Works best with larger documents (up to 5,120 characters)

```
{
  "documents": [
    {
      "id": "1",
      "language": "en",
      "text": "You must be the change you wish
               to see in the world."
    },
    {
      "id": "2",
      "language": "en",
      "text": "The journey of a thousand miles
               begins with a single step."
    }
  ]
}
```

Language (defaults to English if not present)



```
{
  "documents": [
    {
      "id": "1",
      "keyPhrases": [
        "change",
        "world"
      ],
      "warnings": []
    },
    {
      "id": "2",
      "keyPhrases": [
        "miles",
        "single step",
        "journey"
      ],
      "warnings": []
    }
  ],
  "errors": [],
  "modelVersion": "2021-06-01"
}
```

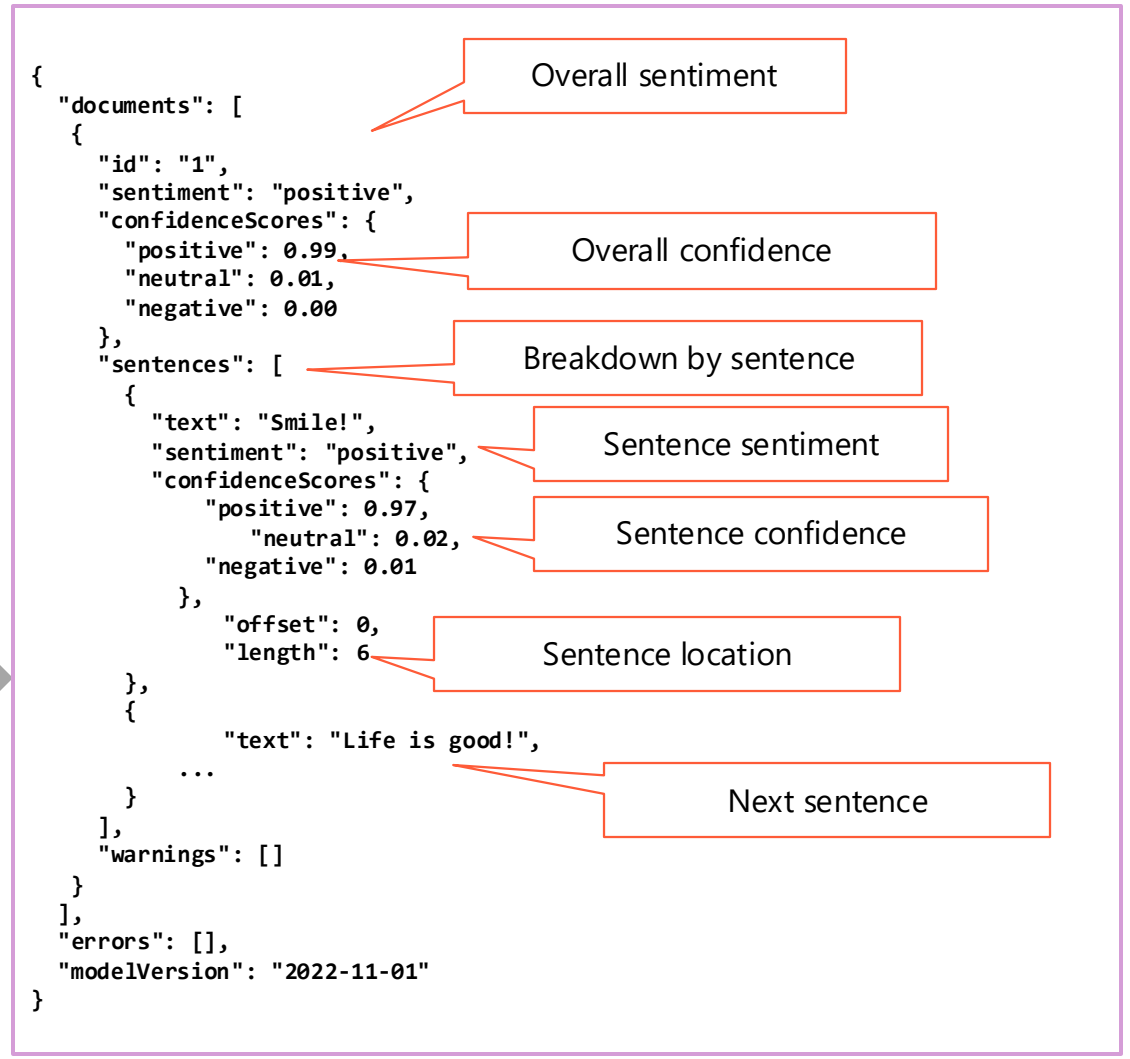
List of key phrases in document 1

List of key phrases in document 2

Sentiment analysis

- Scores overall document sentiment and individual sentence sentiment
- Sentence sentiment is based on confidence scores for *positive*, *negative*, and *neutral*
- Overall document sentiment is based on sentences:
  - All sentences are *neutral* = ***neutral***
  - Sentences include *positive* and *neutral* = ***positive***
  - Sentences include *negative* and *neutral* = ***negative***
  - Sentences include *positive* and *negative* = ***mixed***

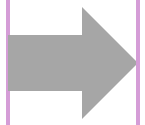
```
{
  "documents": [
    {
      "language": "en",
      "id": "1",
      "text": "Smile! Life is good!"
    }
  ]
}
```



Named entity recognition

- Identifies entities that are mentioned in the text
- Entities are grouped into categories and subcategories, for example:
  - Person
  - Location
  - DateTime
  - Organization
  - Address
  - Email
  - URL
  - Others…

```
{
  "documents": [
    {
      "language": "en",
      "id": "1",
      "text": "Joe went to London on Saturday"
    }
  ]
}
```



```
{
  "documents":[
      {
          "id":"1",
          "entities":[
          {
            "text":"Joe",
            "category":"Person",
            "offset":0,
            "length":3,
            "confidenceScore":0.62
          },
          {
            "text":"London",
            "category":"Location",
            "subcategory":"GPE",
            "offset":12,
            "length":6,
            "confidenceScore":0.88
          },
          {
            "text":"Saturday",
            "category":"DateTime",
            "subcategory":"Date",
            "offset":22,
            "length":8,
            "confidenceScore":0.8
          }
        ],
        "warnings":[]
      }
  ],
  "errors":[],
  "modelVersion":"2021-01-15"
}
```

Person entity

Location entity

DateTime entity

Entity Linking

- Used to disambiguate entities of the same name
  - For example, is “Venus” a planet or a goddess?
- Wikipedia provides the knowledge base
- Specific article links are determined based on entity context within the text

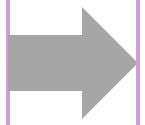
“I saw Venus shining in the sky”:

https://en.wikipedia.org/wiki/Venus

“Venus, the goddess of beauty”:

https://en.wikipedia.org/wiki/Venus_(mythology)

```
{
  "documents": [
    {
      "language": "en",
      "id": "1",
      "text": "I saw Venus shining in the sky"
    }
  ]
}
```



```
{
  "documents":
    [
      {
        "id":"1",
        "entities":[
          {
            "bingId": "89253af3-5b63-e620-9227-f839138139f6"
            "name":"Venus",
            "matches":[
              {
                "text":"Venus",
                "offset":6,
                "length":5,
                "confidenceScore":0.01
              }
            ],
            "language":"en",
            "id":"Venus",
            "url":"https://en.wikipedia.org/wiki/Venus",
            "dataSource":"Wikipedia"
          }
        ],
        "warnings":[]
      }
    ],
  "errors":[],
  "modelVersion":"2021-06-01"
}
```

Named entity

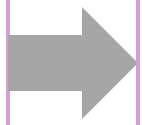
Wikipedia unique article ID

Article link

Summarization

- Can provide two different types of summarization
  - Extractive summarization: Produces summary by using most important sentences
  - Abstractive summarization: Produces a summary capturing the main idea, but not necessarily using the same words as the source document
- Can be customized by training on your own data

```
{
  “analysisInput”: {
    "documents": [{
        "language": "en",
        "id": "1",
        "text": “<long paragraph about Microsoft and
technology>"
     }]
    },
    “tasks": [{
      “kind": "ExtractiveSummarization",
      “taskName": “docExtSummary1",
      “parameters": {
        “sentenceCount”: 2
      }
    }
  ]
}
```



```
{
  “documents”:
    [
      {
        “id”:”1”,
        “sentences":[
          {
            “text": “<first sentence best summarizing document>”
            “rankScore": 0.71
            “offset": 0
            “length”: 135
          },
          {
            “text": “<first sentence best summarizing document>”
            “rankScore":“0.67",
            “offset": 721
            “length”: 203
          },
        ],
        “warnings”:[]
      }
    ],
  “errors”:[],
  “modelVersion”:“latest"
}
```

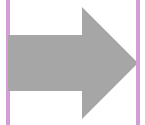
Array of sentences specified

Sentence rank score

Personally Identifiable Information detection

- Used to detect and remove sensitive information
- Entity categories include Person, PhoneNumber, Email, Address, Credit card, and financial account identification
- Can be used in situations like applying sensitivity labels, removing information to reduce bias, and clean data for data science

```
{
  "documents":[
    {
      "id":"1",
      "language": "en",
      "text": "Call our office at 312-555-1234, or send an email
to support@contoso.com"
    }
  ]
}
```



```
{
  "documents":
    [
      {
        "redactedText": "Call our office at ************, or send
           an email to ********************",
        "id": "1",
        "entities": [{
          "text": "312-555-1234",
          "category": "PhoneNumber",
          "offset": 19,
          "length": 12,
          "confidenceScore": 0.8
        }, {
          "text": "support@contoso.com"
          "category": "Email",
          "offset": 53,
          "length": 19,
          "confidenceScore": 0.8
        }],
        "warnings": []
      }
    ],
  "errors":[],
  "modelVersion":"2021-06-01"
}
```

Text with PII removed

All entities detected

Type of PII detected

Confidence score

Exercise – Analyze Text

Detect Language

Evaluate Sentiment

Identify Key Phrases

Extract Entities

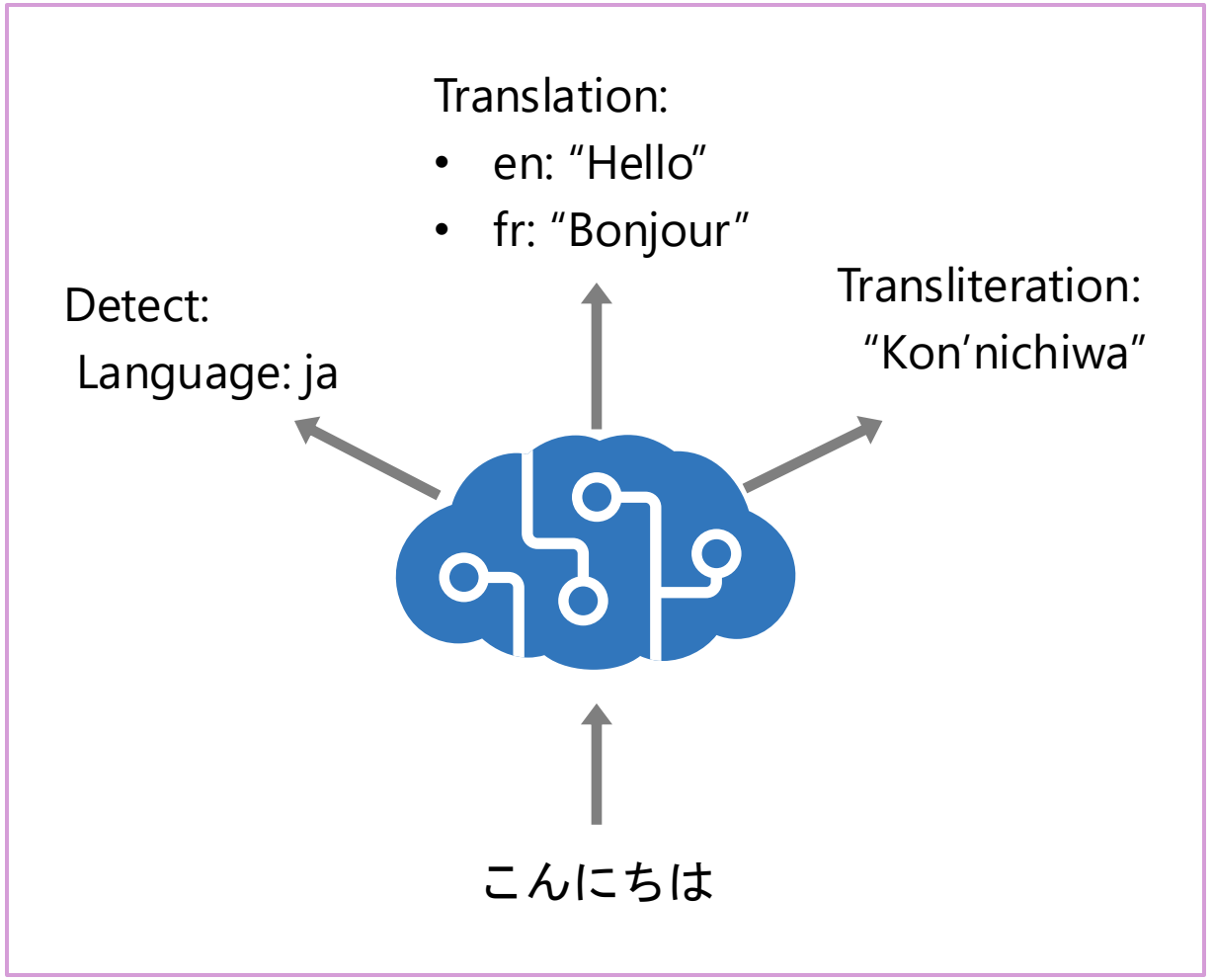
Extract Linked Entities

Translating Text

The Translator Service

Multilingual text translation REST API

- Language *detection*
- One-to-many *translation*
- Script *transliteration*



Detection, Translation, and Transliteration

Detection

https://api.cognitive.microsofttranslator.com/detect?api-version=3.0

Body: [
{ 'Text' : 'こんにちは' }
]

```
[
  {
    "isTranslationSupported": true,
    "isTransliterationSupported": true,
    "language": "ja",
    "score": 1.0
  }
]
```

ISO Language code

Translation

https://api.cognitive.microsofttranslator.com/translate?api-version=3.0
&from=ja&to=en&to=fr

Body: [
{ 'Text' : 'こんにちは' }
]

Add **to** parameters for each target language

```
[
  {'translations':
    [
      {'text': 'Hello', 'to': 'en'},
      {'text': 'Bonjour', 'to': 'fr'}
    ]
  }
]
```

Transliteration

https://api.cognitive.microsofttranslator.com/transliterate?api-version=3.0
&language=ja&fromScript=Jpan&toScript=Latn

Body: [
{ 'Text' : 'こんにちは' }
]

Source text language code

Source text script

Target text script

```
[
    {
        "script": "Latn",
        "text": "Kon'nichiwa"
    }
]
```

Headers omitted for brevity

Translation Options

Word Alignment

```
https://api.cognitive.microsofttranslator.com/translate?api-version=3.0
                                        &from=en&to=zh& includeAlignment=true

Body: [
        { 'Text' : 'Smart Services' }
      ]
```

```
[
  {'translations':
    [
      {'text': '智能服务', 'to': 'zh-Hans',
       'alignment': {'proj': '0:4-0:1 6:13-2:3'}
      }
    ]
  }
]
```

Chars 0-4 in the source are chars 0-1 in the translation

Chars 6-13 in the source are chars 2-3 in the translation

Sentence Length

```
https://api.cognitive.microsofttranslator.com/translate?api-version=3.0
                                &from=en&to=fr&includeSentenceLength=true

Body: [
        { 'Text' : 'Hello world!' }
      ]
```

```
[
  {'translations':
    [
      {'text': 'Salut tout le monde!', 'to': 'fr',
       'sentLen':{'srcSentLen':[12], 'transSentLen':[20]}
      }
    ]
  }
]
```

Source is 12 characters

Translation is 20 characters

Profanity filtering

```
https://api.cognitive.microsofttranslator.com/translate?api-version=3.0
                                        &from=en&to=de&profanityAction=Marked

Body: [
        { 'Text' : 'JSON is [redacted] great!' }
      ]
```

```
[
  {'translations':
    [
      {'text': 'JSON ist *** erstaunlich.', 'to': de'}
    ]
  }
]
```

Default marker for obscenity is asterisk

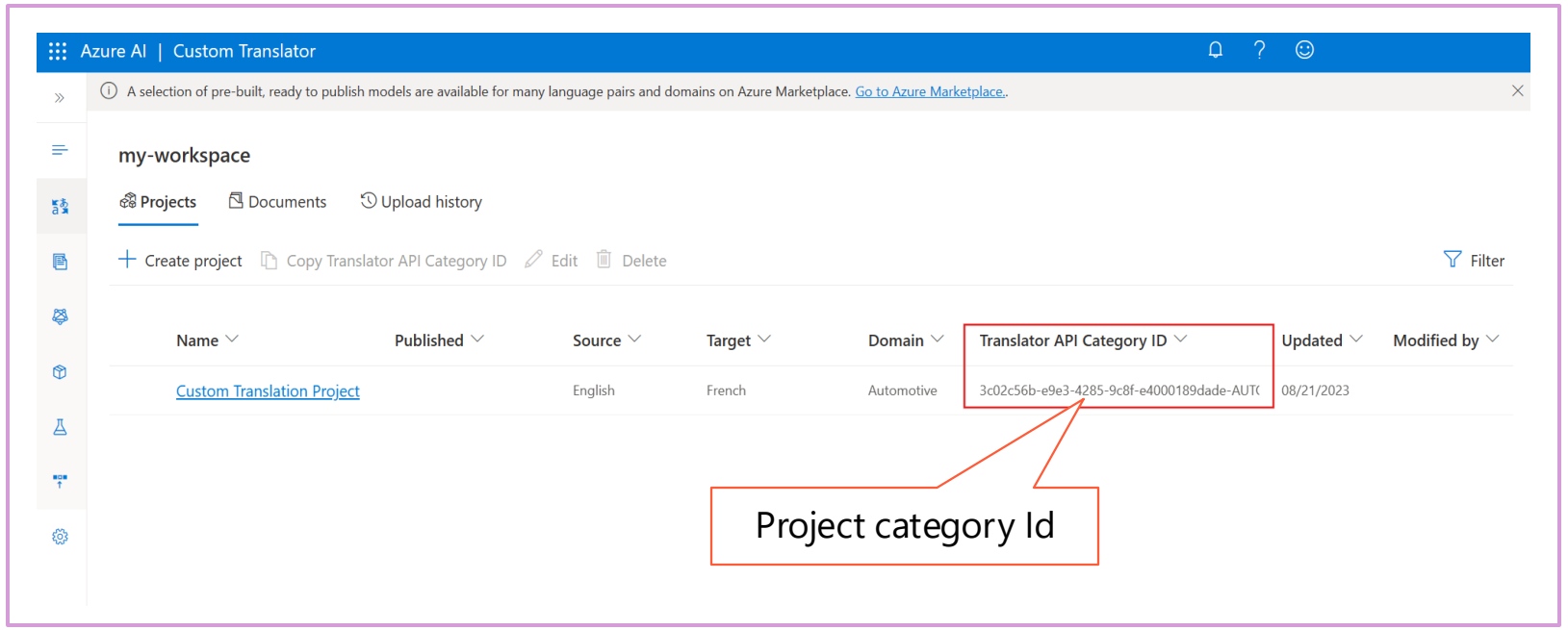
Custom Translation

Create a custom translation model

1. Use the Custom Translator portal
2. Link a workspace to your Azure AI Translator resource
3. Create a project
4. Upload training data files
5. Train a model

Call your model through the Translator API

- Specify a **category** parameter with the project category Id



Demo – Translate Text

Detect language

Translate text