3.1 - Analyze text with Azure AI Language

Overview

Natural language processing (NLP) solutions use language models to interpret the semantic meaning of written or spoken language. You can use the Language Understanding service to build language models for your applications.

Introduction

Every day, the world generates a vast quantity of data; much of it text-based in the form of emails, social media posts, online reviews, business documents, and more. Artificial intelligence techniques that apply statistical and semantic models enable you to create applications that extract meaning and insights from this text-based data.

The **Azure AI Language** provides an API for common text analysis techniques that you can easily integrate into your own application code.

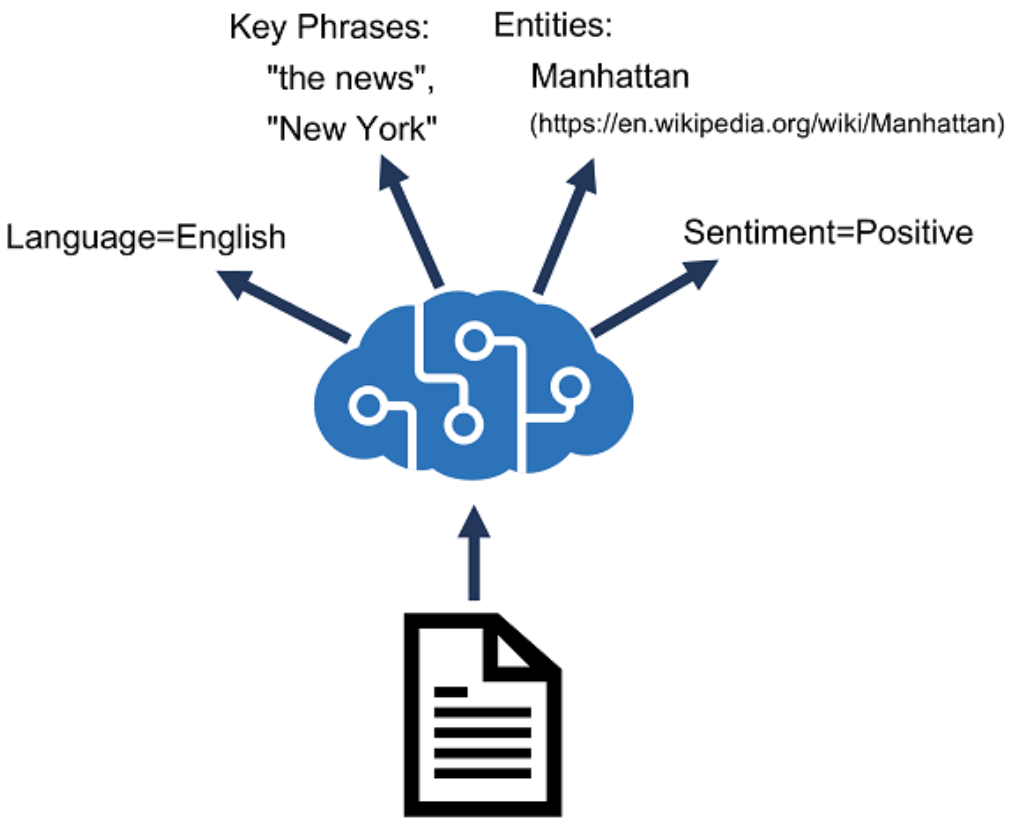
In this module, you will learn how to use Azure AI Language to:

- Detect language from text.
- Analyze text sentiment.
- Extract key phrases, entities, and linked entities.

Provision an Azure AI Language resource

Azure AI Language is designed to help you extract information from text. It provides functionality that you can use for:

- *Language detection* - determining the language in which text is written.
- *Key phrase extraction* - identifying important words and phrases in the text that indicate the main points.
- *Sentiment analysis* - quantifying how positive or negative the text is.
- *Named entity recognition* - detecting references to entities, including people, locations, time periods, organizations, and more.
- *Entity linking* - identifying specific entities by providing reference links to Wikipedia articles.



Azure resources for text analysis

To use Azure AI Language to analyze text, you must provision a resource for it in your Azure subscription.

After you have provisioned a suitable resource in your Azure subscription, you can use its **endpoint** and one of its **keys** to call the Azure AI Language APIs from your code. You can call the Azure AI Language

APIs by submitting requests in JSON format to the REST interface, or by using any of the available programming language-specific SDKs.

> Note: The code examples in the subsequent units in this module show the JSON requests and responses exchanged with the REST interface. When using an SDK, the JSON requests are abstracted by appropriate objects and methods that encapsulate the same data values. You'll get a chance to try the SDK for C# or Python for yourself in the exercise later in the module.

Detect language

The Azure AI Language detection API evaluates text input and, for each document submitted, returns language identifiers **with a score indicating the strength of the analysis**.

This capability is useful for content stores that collect arbitrary text, where language is unknown. Another scenario could involve a chat bot. If a user starts a session with the chat bot, language detection can be used to determine which language they are using and allow you to configure your bot responses in the appropriate language.

You can parse the results of this analysis to determine which language is used in the input document. The response also returns a score, which reflects the **confidence of the model (a value between 0 and 1)**.

Language detection can work with documents or single phrases. It's important to note that the **document size must be under 5,120 characters**. The size limit is per document and each collection is restricted to **1,000 items** (IDs).

A sample of a properly formatted JSON payload that you might submit to the service in the request body is shown here, including a collection of **documents**, each containing a unique **id** and the **text** to be analyzed. Optionally, you can provide a **countryHint to improve prediction performance.**

```
{
    "kind": "LanguageDetection",
    "parameters": {
        "modelVersion": "latest"
    },
    "analysisInput":{
        "documents":[
              {
                "id": "1",
                "text": "Hello world",
                "countryHint": "US"
              },
              {
                "id": "2",
                "text": "Bonjour tout le monde"
              }
        ]
    }
}
```

The service will return a JSON response that contains a result for each **document** in the request body, including the **predicted language and a value indicating the confidence level of the prediction**. The confidence level is a value ranging from 0 to 1 with values closer to 1 being a higher confidence level. Here's an example of a standard JSON response that maps to the above request JSON.


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


In our sample, all of the languages show a confidence of 1, mostly because the text is relatively simple and easy to identify the language for.

If you pass in a document that has multilingual content, the service will behave a bit differently. Mixed language content within the same document returns the language with the largest representation in the content, but with a lower positive rating, reflecting the marginal strength of that assessment. In the following example, the input is a blend of English, Spanish, and French. The analyzer uses statistical analysis of the text to determine the *predominant* language.

```
{
  "documents": [
    {
      "id": "1",
      "text": "Hello, I would like to take a class at your University. ¿Se ofrecen
clases en español? Es mi primera lengua y más fácil para escribir. Que diriez-vous des
cours en français?"
```

```
    }
  ]
}
```

The following sample shows a response for this multi-language example.

```
{
    "documents": [
        {
            "id": "1",
            "detectedLanguage": {
                "name": "Spanish",
                "iso6391Name": "es",
                "confidenceScore": 0.9375
            },
            "warnings": []
        }
    ],
    "errors": [],
    "modelVersion": "2022-10-01"
}
```

The last condition to consider is when there is ambiguity as to the language content. The scenario might happen if you submit textual content that the analyzer is not able to parse, for example because of **character encoding issues** when converting the text to a string variable. As a result, the response for the language name and ISO code will indicate (**unknown**) and the score value will be returned as `0`. The following example shows how the response would look.

```
{
    "documents": [
        {
            "id": "1",
            "detectedLanguage": {
                "name": "(Unknown)",
                "iso6391Name": "(Unknown)",
                "confidenceScore": 0.0
            },
            "warnings": []
        }
    ],
    "errors": [],
    "modelVersion": "2022-10-01"
}
```

Extract key phrases

Key phrase extraction is the process of evaluating the text of a document, or documents, and then identifying the main points around the context of the document(s).

Key phrase extraction works best for larger documents (the maximum size that can be analyzed is 5,120 characters).

As with language detection, the REST interface enables you to submit one or more documents for analysis.

```
{
    "kind": "KeyPhraseExtraction",
    "parameters": {
        "modelVersion": "latest"
    },
    "analysisInput":{
        "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."
            }
        ]
    }
}
```

The response contains a list of key phrases detected in each document:

```
{
    "kind": "KeyPhraseExtractionResults",
    "results": {
    "documents": [
        {
         "id": "1",
         "keyPhrases": [
           "change",
           "world"
         ],
         "warnings": []
       },
       {
         "id": "2",
```

```
          "keyPhrases": [
            "miles",
            "single step",
            "journey"
          ],
          "warnings": []
        }
],
    "errors": [],
    "modelVersion": "2021-06-01"
    }
}
```

Analyze sentiment

Sentiment analysis is used to evaluate how positive or negative a text document is, which can be useful in various workloads, such as:

- Evaluating a movie, book, or product by quantifying sentiment based on reviews.
- Prioritizing customer service responses to correspondence received through email or social media messaging.

When using Azure AI Language to evaluate sentiment, the response includes **overall document sentiment and individual sentence sentiment** for each document submitted to the service.

For example, you could submit a single document for sentiment analysis like this:

```
{
  "kind": "SentimentAnalysis",
  "parameters": {
    "modelVersion": "latest"
  },
  "analysisInput": {
    "documents": [
      {
        "id": "1",
        "language": "en",
        "text": "Good morning!"
      }
    ]
  }
}
```

The response from the service might look like this:

```
{
  "kind": "SentimentAnalysisResults",
```

```
  "results": {
    "documents": [
      {
        "id": "1",
        "sentiment": "positive",
        "confidenceScores": {
          "positive": 0.89,
          "neutral": 0.1,
          "negative": 0.01
        },
        "sentences": [
          {
            "sentiment": "positive",
            "confidenceScores": {
              "positive": 0.89,
              "neutral": 0.1,
              "negative": 0.01
            },
            "offset": 0,
            "length": 13,
            "text": "Good morning!"
          }
        ],
        "warnings": []
      }
    ],
    "errors": [],
    "modelVersion": "2022-11-01"
  }
}
```


Sentence sentiment is based on confidence scores for **positive**, **negative**, and **neutral** classification values between 0 and 1.

Overall document sentiment is based on sentences:

- If all sentences are neutral, the overall sentiment is neutral.
- If sentence classifications include only positive and neutral, the overall sentiment is positive.
- If the sentence classifications include only negative and neutral, the overall sentiment is negative.
- If the sentence classifications include positive and negative, the overall sentiment is mixed.

Extract entities

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

> Note: For a full list of categories, see the documentation.

Input for entity recognition is similar to input for other Azure AI Language API functions:

```
{
  "kind": "EntityRecognition",
  "parameters": {
    "modelVersion": "latest"
  },
  "analysisInput": {
    "documents": [
      {
        "id": "1",
        "language": "en",
        "text": "Joe went to London on Saturday"
      }
    ]
  }
}
```

The response includes a list of categorized entities found in each document:

```
{
    "kind": "EntityRecognitionResults",
     "results": {
          "documents":[
              {
                  "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
                }
              ],
              "id":"1",
              "warnings":[]
            }
          ],
          "errors":[],
          "modelVersion":"2021-01-15"
    }
}
```


To learn more about entities see the Build a conversational language understanding model module.

Extract linked entities

In some cases, the same name might be applicable to more than one entity. For example, does an instance of the word "Venus" refer to the planet or the goddess from mythology?

Entity linking can be used to disambiguate entities of the same name by referencing an article in a knowledge base. Wikipedia provides the knowledge base for the Text Analytics service. Specific article links are determined based on entity context within the text.

For example, "I saw Venus shining in the sky" is associated with the link https://en.wikipedia.org/wiki/Venus; while "Venus, the goddess of beauty" is associated with https://en.wikipedia.org/wiki/Venus_(mythology).

As with all Azure AI Language service functions, you can submit one or more documents for analysis:


```
{
  "kind": "EntityLinking",
  "parameters": {
    "modelVersion": "latest"
  },
  "analysisInput": {
    "documents": [
      {
        "id": "1",
        "language": "en",
        "text": "I saw Venus shining in the sky"
      }
    ]
```

```
  }
}
```

The response includes the **entities identified in the text along with links to associated articles:**

```
{
  "kind": "EntityLinkingResults",
  "results": {
    "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"
  }
}
```

Exercise - Analyze text

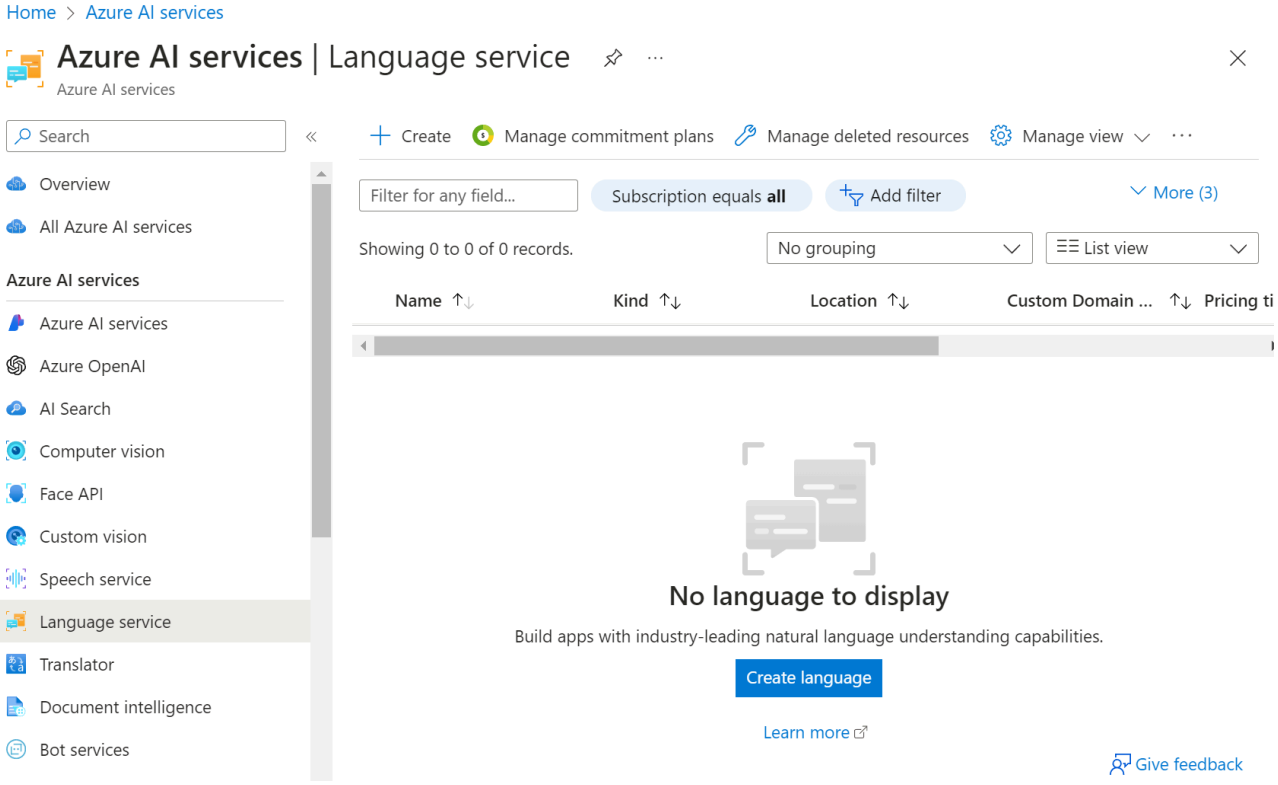
Azure Language supports analysis of text, including language detection, sentiment analysis, key phrase extraction, and entity recognition.

For example, suppose a travel agency wants to process hotel reviews that have been submitted to the company's web site. By using the Azure AI Language, they can determine the language each review is written in, the sentiment (positive, neutral, or negative) of the reviews, key phrases that might indicate the main topics discussed in the review, and named entities, such as places, landmarks, or people mentioned in the reviews.

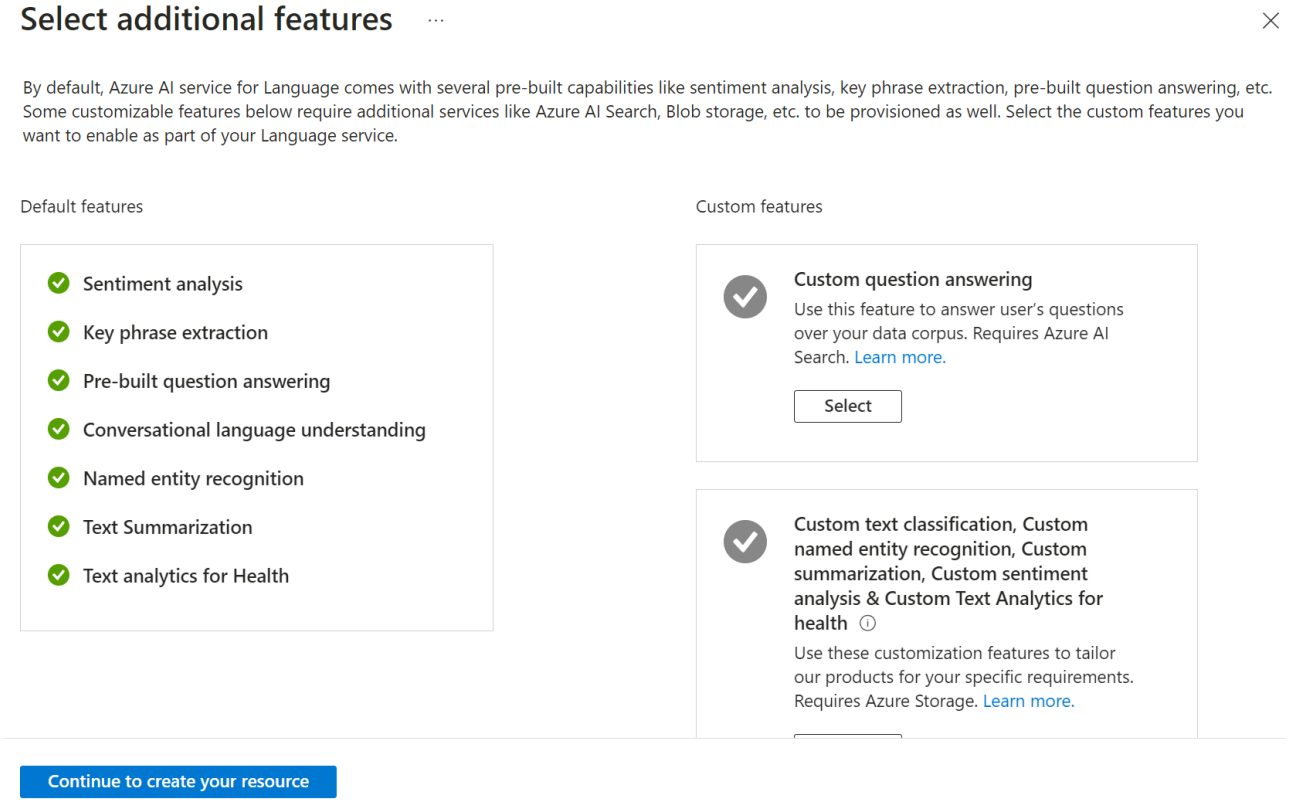
Provision an *Azure AI Language* resource

If you don't already have one in your subscription, you'll need to provision an **Azure AI Language service** resource in your Azure subscription.

1. Open the Azure portal at `https://portal.azure.com`, and sign in using the Microsoft account associated with your Azure subscription.
2. In the search field at the top, search for **Azure AI services**. Then, in the results, select **Create** under **Language Service**.



3. Select **Continue to create your resource**.



4. Provision the resource using the following settings:

- **Subscription**: *Your Azure subscription*.
- **Resource group**: *Choose or create a resource group*.
- **Region**: *Choose any available region*
- **Name**: *Enter a unique name*.
- **Pricing tier**: Select **F0** (*free*), or **S** (*standard*) if F is not available.
- **Responsible AI Notice**: Agree.

5. Select **Review + create**, then select **Create** to provision the resource.
6. Wait for deployment to complete, and then go to the deployed resource.
7. View the **Keys and Endpoint** page. You will need the information on this page later in the exercise.

Prepare to develop an app in Visual Studio Code

You'll develop your text analytics app using Visual Studio Code. The code files for your app have been provided in a GitHub repo.

> **Tip**: If you have already cloned the **mslearn-ai-language** repo, open it in Visual Studio code. Otherwise, follow these steps to clone it to your development environment.

1. Start Visual Studio Code.
2. Open the palette (SHIFT+CTRL+P) and run a **Git: Clone** command to clone the `https://github.com/MicrosoftLearning/mslearn-ai-language` repository to a local folder (it doesn't matter which folder).
3. When the repository has been cloned, open the folder in Visual Studio Code.

> **Note**: If Visual Studio Code shows you a pop-up message to prompt you to trust the code you are opening, click on **Yes, I trust the authors** option in the pop-up.

4. Wait while additional files are installed to support the C# code projects in the repo.

> **Note**: If you are prompted to add required assets to build and debug, select **Not Now**.

Configure your application

Applications for both C# and Python have been provided, as well as a sample text file you'll use to test the summarization. Both apps feature the same functionality. First, you'll complete some key parts of the application to enable it to use your Azure AI Language resource.

1. In Visual Studio Code, in the **Explorer** pane, browse to the **Labfiles/01-analyze-text** folder and expand the **CSharp** or **Python** folder depending on your language preference and the **text-analysis** folder it contains. Each folder contains the language-specific files for an app into which you're you're going to integrate Azure AI Language text analytics functionality.
2. Right-click the **text-analysis** folder containing your code files and open an integrated terminal. Then install the Azure AI Language Text Analytics SDK package by running the appropriate command for your language preference. For the Python exercise, also install the `dotenv` package:

   C#:

   ```
   dotnet add package Azure.AI.TextAnalytics --version 5.3.0
   ```

   Python:

```
pip install azure-ai-textanalytics==5.3.0
pip install python-dotenv
```

3. In the **Explorer** pane, in the **text-analysis** folder, open the configuration file for your preferred language
   - **C#**: appsettings.json
   - **Python**: .env
4. Update the configuration values to include the **endpoint** and a **key** from the Azure Language resource you created (available on the **Keys and Endpoint** page for your Azure AI Language resource in the Azure portal)
5. Save the configuration file.
6. Note that the **text-analysis** folder contains a code file for the client application:

   - **C#**: Program.cs
   - **Python**: text-analysis.py

   Open the code file and at the top, under the existing namespace references, find the comment **Import namespaces**. Then, under this comment, add the following language-specific code to import the namespaces you will need to use the Text Analytics SDK:

   C#: Programs.cs
   ```
   // import namespaces using Azure; using Azure.AI.TextAnalytics;
   ```

   Python: text-analysis.py (View here: text-analysis.py)
   ```
   # import namespaces from azure.core.credentials import AzureKeyCredential from azure.ai.textanalytics import TextAnalyticsClient
   ```
7. In the **Main** function, note that code to load the Azure AI Language service endpoint and key from the configuration file has already been provided. Then find the comment **Create client using endpoint and key**, and add the following code to create a client for the Text Analysis API:

   C#: Programs.cs
   ```
   // Create client using endpoint and key AzureKeyCredential credentials = new AzureKeyCredential(aiSvcKey); Uri endpoint = new Uri(aiSvcEndpoint); TextAnalyticsClient aiClient = new TextAnalyticsClient(endpoint, credentials);
   ```

   Python: text-analysis.py (View here: text-analysis.py)
   ```
   # Create client using endpoint and key credential = AzureKeyCredential(ai_key) ai_client = TextAnalyticsClient(endpoint=ai_endpoint, credential=credential)
   ```
8. Save your changes and return to the integrated terminal for the **text-analysis** folder, and enter the following command to run the program:
   - **C#**: `dotnet run`
   - **Python**: `python text-analysis.py`

   > **Tip**: You can use the **Maximize panel size** (**^**) icon in the terminal toolbar to see more of the console text.

9. Observe the output as the code should run without error, displaying the contents of each review text file in the **reviews** folder. The application successfully creates a client for the Text Analytics API but doesn't make use of it. We'll fix that in the next procedure.

Add code to detect language

Now that you have created a client for the API, let's use it to detect the language in which each review is written.

1. In the **Main** function for your program, find the comment **Get language**. Then, under this comment, add the code necessary to detect the language in each review document:

   C#: Programs.cs
   ```
   // Get language DetectedLanguage detectedLanguage = aiClient.DetectLanguage(text);
   Console.WriteLine($"\nLanguage: {detectedLanguage.Name}");
   ```

   Python: text-analysis.py (View here: text-analysis.py)
   ```
   # Get language detectedLanguage = ai_client.detect_language(documents=[text])[0]
   print('\nLanguage: {}'.format(detectedLanguage.primary_language.name))
   ```

   > **Note**: *In this example, each review is analyzed individually, resulting in a separate call to the service for each file.* ***An alternative approach is to create a collection of documents and pass them to the service in a single call.*** *In both approaches, the response from the service consists of a collection of documents; which is why in the Python code above, the index of the first (and only) document in the response ([0]) is specified.*

2. Save your changes. Then return to the integrated terminal for the **text-analysis** folder, and re-run the program.
3. Observe the output, noting that this time the language for each review is identified.

Add code to evaluate sentiment

Sentiment analysis is a commonly used technique to classify text as *positive* or *negative* (or possible *neutral* or *mixed*). It's commonly used to analyze social media posts, product reviews, and other items where the sentiment of the text may provide useful insights.

1. In the **Main** function for your program, find the comment **Get sentiment**. Then, under this comment, add the code necessary to detect the sentiment of each review document:

   C#: Program.cs
   ```
   // Get sentiment DocumentSentiment sentimentAnalysis = aiClient.AnalyzeSentiment(text);
   Console.WriteLine($"\nSentiment: {sentimentAnalysis.Sentiment}");
   ```

   Python: text-analysis.py (View here: text-analysis.py)
   ```
   # Get sentiment sentimentAnalysis = ai_client.analyze_sentiment(documents=[text])[0]
   print("\nSentiment: {}".format(sentimentAnalysis.sentiment))
   ```
2. Save your changes. Then return to the integrated terminal for the **text-analysis** folder, and re-run the program.
3. Observe the output, noting that the sentiment of the reviews is detected.

Add code to identify key phrases

It can be useful to identify key phrases in a body of text to help determine the main topics that it discusses.

1. In the **Main** function for your program, find the comment **Get key phrases**. Then, under this comment, add the code necessary to detect the key phrases in each review document:

C#: Program.cs

```
// Get key phrases KeyPhraseCollection phrases = aiClient.ExtractKeyPhrases(text); if (phrases.Count > 0) { Console.WriteLine("\nKey Phrases:"); foreach(string phrase in phrases) { Console.WriteLine($"\t{phrase}"); } }
```

Python: text-analysis.py (View here: text-analysis.py)

```
# Get key phrases phrases = ai_client.extract_key_phrases(documents=[text])[0].key_phrases if len(phrases) > 0: print("\nKey Phrases:") for phrase in phrases: print('\t{}'.format(phrase))
```

2. Save your changes. Then return to the integrated terminal for the **text-analysis** folder, and re-run the program.
3. Observe the output, noting that each document contains key phrases that give some insights into what the review is about.

Add code to extract entities

Often, documents or other bodies of text mention people, places, time periods, or other entities. The text Analytics API can detect multiple categories (and subcategories) of entity in your text.

1. In the **Main** function for your program, find the comment **Get entities**. Then, under this comment, add the code necessary to identify entities that are mentioned in each review:

   C#: Program.cs

   ```
   // Get entities CategorizedEntityCollection entities = aiClient.RecognizeEntities(text); if (entities.Count > 0) { Console.WriteLine("\nEntities:"); foreach(CategorizedEntity entity in entities) { Console.WriteLine($"\t{entity.Text} ({entity.Category})"); } }
   ```

   Python: text-analysis.py (View here: text-analysis.py)

   ```
   # Get entities entities = ai_client.recognize_entities(documents=[text])[0].entities if len(entities) > 0: print("\nEntities") for entity in entities: print('\t{} ({})'.format(entity.text, entity.category))
   ```

2. Save your changes. Then return to the integrated terminal for the **text-analysis** folder, and re-run the program.
3. Observe the output, noting the entities that have been detected in the text.

Add code to extract linked entities

In addition to categorized entities, the Text Analytics API can detect entities for which there are known links to data sources, such as Wikipedia.

1. In the **Main** function for your program, find the comment **Get linked entities**. Then, under this comment, add the code necessary to identify linked entities that are mentioned in each review:

   C#: Program.cs

   ```
   // Get linked entities LinkedEntityCollection linkedEntities = aiClient.RecognizeLinkedEntities(text); if (linkedEntities.Count > 0) { Console.WriteLine("\nLinks:"); foreach(LinkedEntity linkedEntity in linkedEntities) { Console.WriteLine($"\t{linkedEntity.Name} ({linkedEntity.Url})"); } }
   ```

   Python: text-analysis.py (View here: text-analysis.py)

   ```
   # Get linked entities entities = ai_client.recognize_linked_entities(documents=[text])
   ```

`[0].entities if len(entities) > 0: print("\nLinks") for linked_entity in entities: print('\t{} ({})'.format(linked_entity.name, linked_entity.url))`

2. Save your changes. Then return to the integrated terminal for the **text-analysis** folder, and re-run the program.
3. Observe the output, noting the linked entities that are identified.

Clean up resources

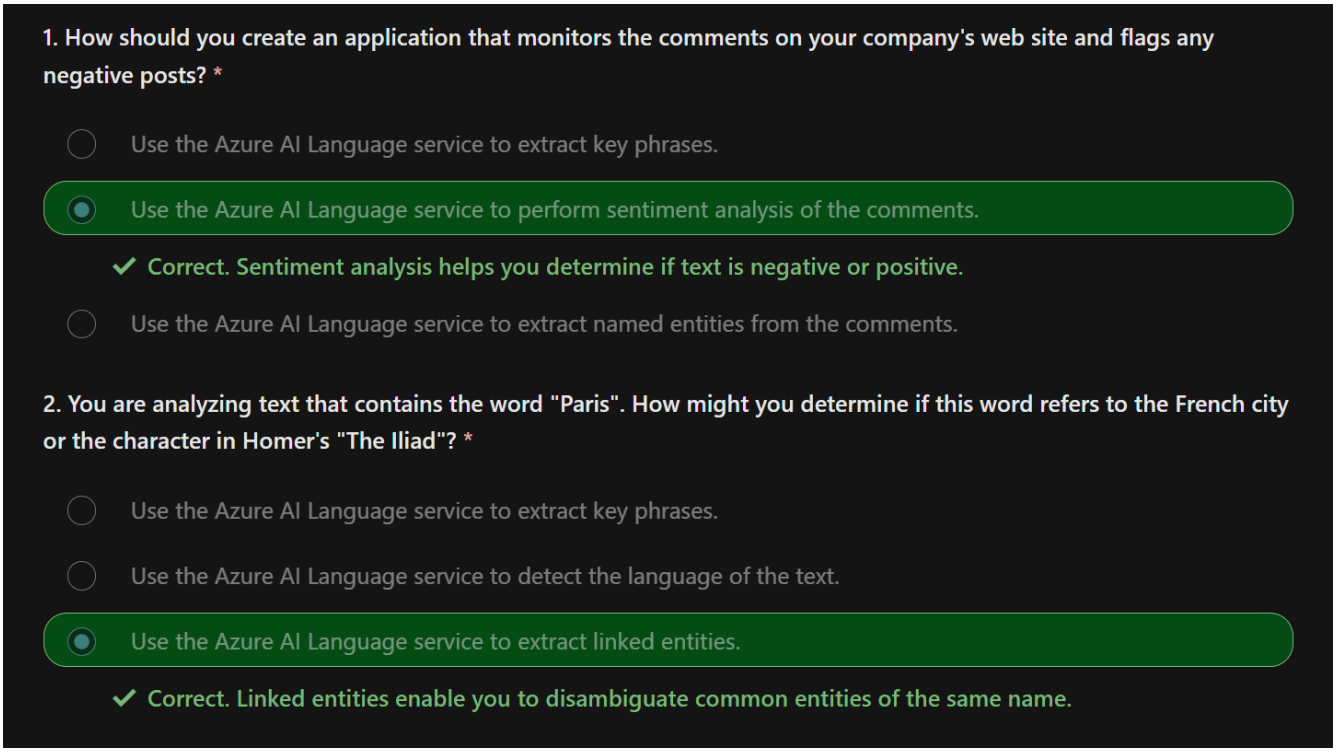
If you're finished exploring the Azure AI Language service, you can delete the resources you created in this exercise. Here's how:

1. Open the Azure portal at `https://portal.azure.com`, and sign in using the Microsoft account associated with your Azure subscription.
2. Browse to the Azure AI Language resource you created in this lab.
3. On the resource page, select **Delete** and follow the instructions to delete the resource.

More information

For more information about using **Azure AI Language**, see the documentation.

Knowledge Check



Summary

In this module, you learned how to use Azure AI Language to:

- Detect language from text.
- Analyze text sentiment.

- Extract key phrases, entities, and linked entities.

To learn more about Azure AI Language and some of the concepts covered in this module, you can explore the following:

- Azure AI Language documentation
- Build a conversational language understanding model
- Create a custom named entity extraction solution

✍️ Compiled by Kenneth Leung (2025)