



Section 5

Natural Language Processing in Microsoft Azure

Overview of NLP Services in Azure

- **Azure Cognitive Services**

Services	Pre-trained Models	Custom Models	Description
Text Analytics	X		Detect sentiment, key phrases, and named entities
Speech – Speech-to-Text (Speech Recognition)	X	X	Transcribe audible speech into readable, searchable text
Speech – Text-to-Speech (Speech Synthesis)	X	X	Convert text to lifelike speech for more natural interfaces
Speech – Speech-Translation	X		Integrate real-time speech translation into your apps
Translator	X	X	Detect and translate more than 90 supported languages
Language Understanding	X	X	Build natural language understanding into apps, bots, and IoT devices



Text Analytics Service



Text Analytics Service – Language Detection

Review #1

Fantastic castle and beautiful gardens
Larnach Castle, Dunedin, New Zealand
16/12/2015

This is a unique place with more than a hundred and forty years of history. It's called New Zealand's only Castle. It's a must-see place in Dunedin. We stayed a night. We really enjoyed our stay at Larnach Castle. Clean rooms, good service, amazing location with incredible views of the Otago Harbour. The dinner was fantastic. We also really enjoyed exploring the gardens and flowers. It's an unforgettable visit.

- Language: English
- Code: en
- Score: 1.0

Review #2

梦幻般的城堡和美丽的花园
拉纳赫城堡，但尼丁，新西兰
16/12/2015

这是一个有着一百四十多年历史的独特地方。它被称为新西兰唯一的城堡。这是但尼丁必看的地方。我们住了一晚。我们真的很喜欢我们在拉纳赫城堡的住宿。干净的房间，优质的服务，优越的地理位置，可欣赏到奥塔哥海港的壮丽景色。晚餐很棒。我们也非常喜欢探索花园和鲜花。这是一次难忘的访问。

- Language: Chinese_Simplified
- Code: zh_chs
- Score: 1.0

Language Detection

- Language name
- IETF BCP-47 language tag
- **ISO 639-1 language code** - a two-letter lowercase abbreviation

Examples:

- en – English
- es – Spanish
- de – German
- fr – French
- hi – Hindi
- ja – Japanese
- ko – Korean
- ru – Russian
- zh – Chinese

- Confidence score (0-1)

Text Analytics Service – Language Detection

Review #3

C'est incroyable - Fantastic castle and beautiful gardens
Larnach Castle, Dunedin, New Zealand
16/12/2015

*This is a unique place with more than a hundred and forty years of history. It's called New Zealand's only Castle. **C'est un endroit incontournable.** We stayed a night. We really enjoyed our stay at Larnach Castle. Clean rooms, good service, amazing location with incredible views of the Otago Harbour. The dinner was fantastic. We also really enjoyed exploring the gardens and flowers. It's an unforgettable visit.*

Mixture of English & French

```
- Language: English
- Code: en
- Score: 0.9642857313156128
```

French words commonly used in both English & French	aviation	country_hint = 'us' Language: English with confidence: 54.00%
		country_hint = 'fr' Language: French with confidence: 100.00%
	illusion	country_hint = 'us' Language: English with confidence: 27.00%
		country_hint = 'fr' Language: French with confidence: 100.00%
Emoticons / Kaomoji faces	:-) :) :-3 :-> 8-) :-} *< :-) (>_<) (^_^;) ^_^ (?_?) Language: unknown with confidence: NaN	

Mixed-language content

- Returns **predominant language**

Ambiguous content

- Limited text or only punctuation
- countryHint** parameter
- Default countryHint – 'US' United States
- Language can't be detected
 - Name/code: **unknown**
 - Score: **NaN (Not a number)**

Text Analytics Service – Sentiment Analysis

Review #1

Fantastic castle and beautiful gardens
Larnach Castle, Dunedin, New Zealand
16/12/2015

*This is a **unique** place with more than a hundred and forty years of history. It's called New Zealand's only Castle. It's a **must-see** place in Dunedin. We stayed a night. We really **enjoyed** our stay at Larnach Castle. **Clean** rooms, **good** service, **amazing** location with **incredible** views of the Otago Harbour. The dinner was **fantastic**. We also really **enjoyed** exploring the gardens and flowers. It's an **unforgettable** visit.*

Document Sentiment: positive

Overall scores: positive=0.96; neutral=0.04; negative=0.00

Review #2

The Worst Hotel Ever
The XXX Hotel
17/12/2015

*The room was **dirty** and the service was **terrible**. Our experience at this hotel was really **bad**. We were shocked by the staff's **unprofessional** services. I **won't recommend** it to anyone. **Don't make the same mistake** like we did.*

Document Sentiment: negative

Overall scores: positive=0.00; neutral=0.00; negative=1.00

Sentiment Analysis

- Label

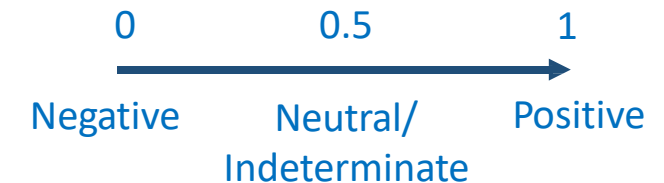
Positive: \geq one **positive** sentence + **reset neutral**

Negative: \geq one **negative** sentence + **reset neutral**

Neutral: **All neutral** sentences

Mixed: \geq one **positive** + \geq one **negative** sentence
(Document Level)

- Confidence score



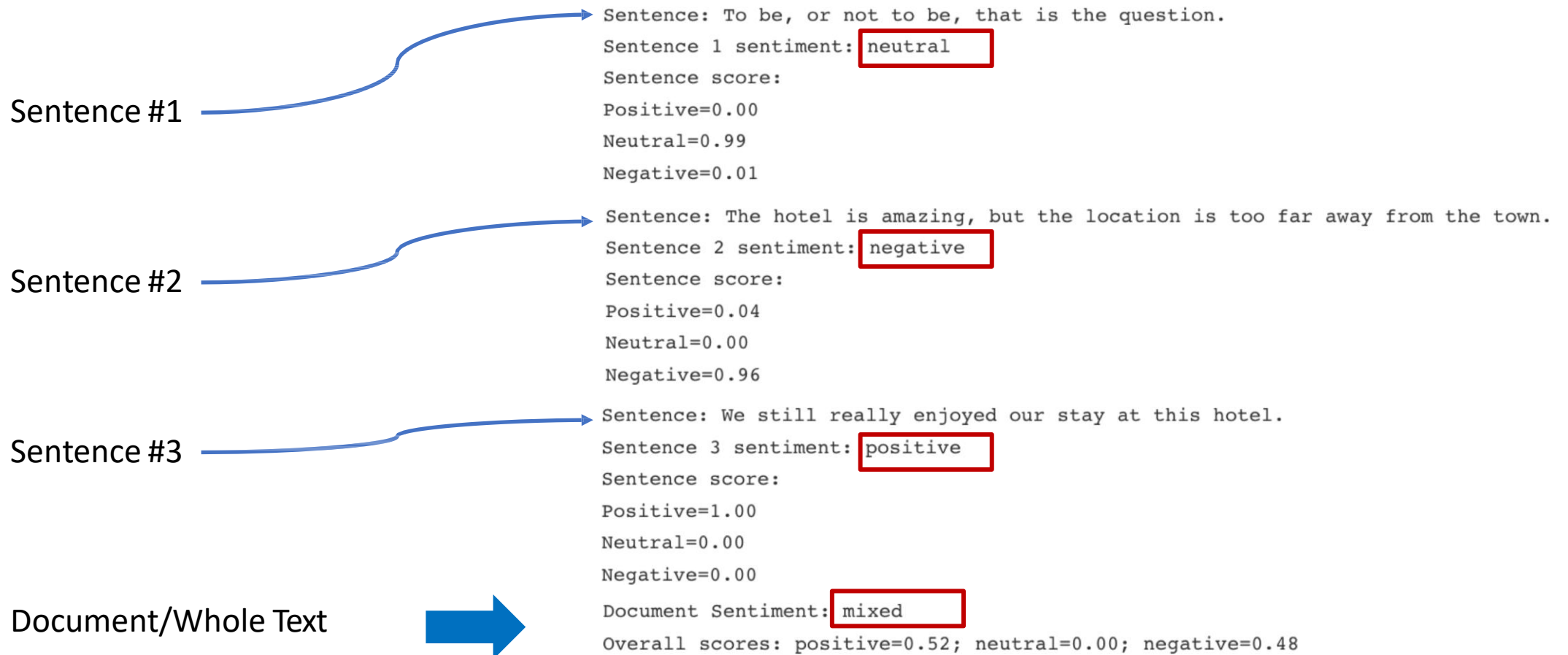
- Indeterminate Sentiment

- No sufficient context or insufficient phrasing
- Wrong language code

Text Analytics Service – Sentiment Analysis

Text Sample:

"To be, or not to be, that is the question. The hotel is amazing, but the location is too far away from the town. We still really enjoyed our stay at this hotel."



Text Analytics Service – Key Phrase Extraction

Review #1

Fantastic castle and beautiful gardens

Larnach Castle, Dunedin, New Zealand

16/12/2015

*This is a **unique place** with more than a hundred and forty **years of history**. It's called **New Zealand's** only Castle. It's a **must-see place** in **Dunedin**. We stayed a **night**. We really enjoyed our **stay** at **Larnach Castle**. **Clean rooms, good service, amazing location** with **incredible views** of the **Otago Harbour**. The **dinner** was fantastic. We also really enjoyed exploring the gardens and **flowers**. It's an **unforgettable visit**.*

Key Phrases:

Larnach Castle
Fantastic castle
Dunedin
New Zealand's
beautiful gardens
must-see place
unique place
amazing location
incredible views
good service
Clean rooms
Otago Harbour
stay
years of history
unforgettable visit
dinner
flowers
night

Key Phrase Extraction

- List of main/key points

Text Analytics Service – Entity Recognition

Review #1

Fantastic castle and beautiful gardens
Larnach Castle, Dunedin, New Zealand
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This is a unique place with more than a hundred and forty years of history. It's called New Zealand's only Castle. It's a must-see place in Dunedin. We stayed a night. We really enjoyed our stay at Larnach Castle. Clean rooms, good service, amazing location with incredible views of the Otago Harbour. The dinner was fantastic. We also really enjoyed exploring the gardens and flowers. It's an unforgettable visit.

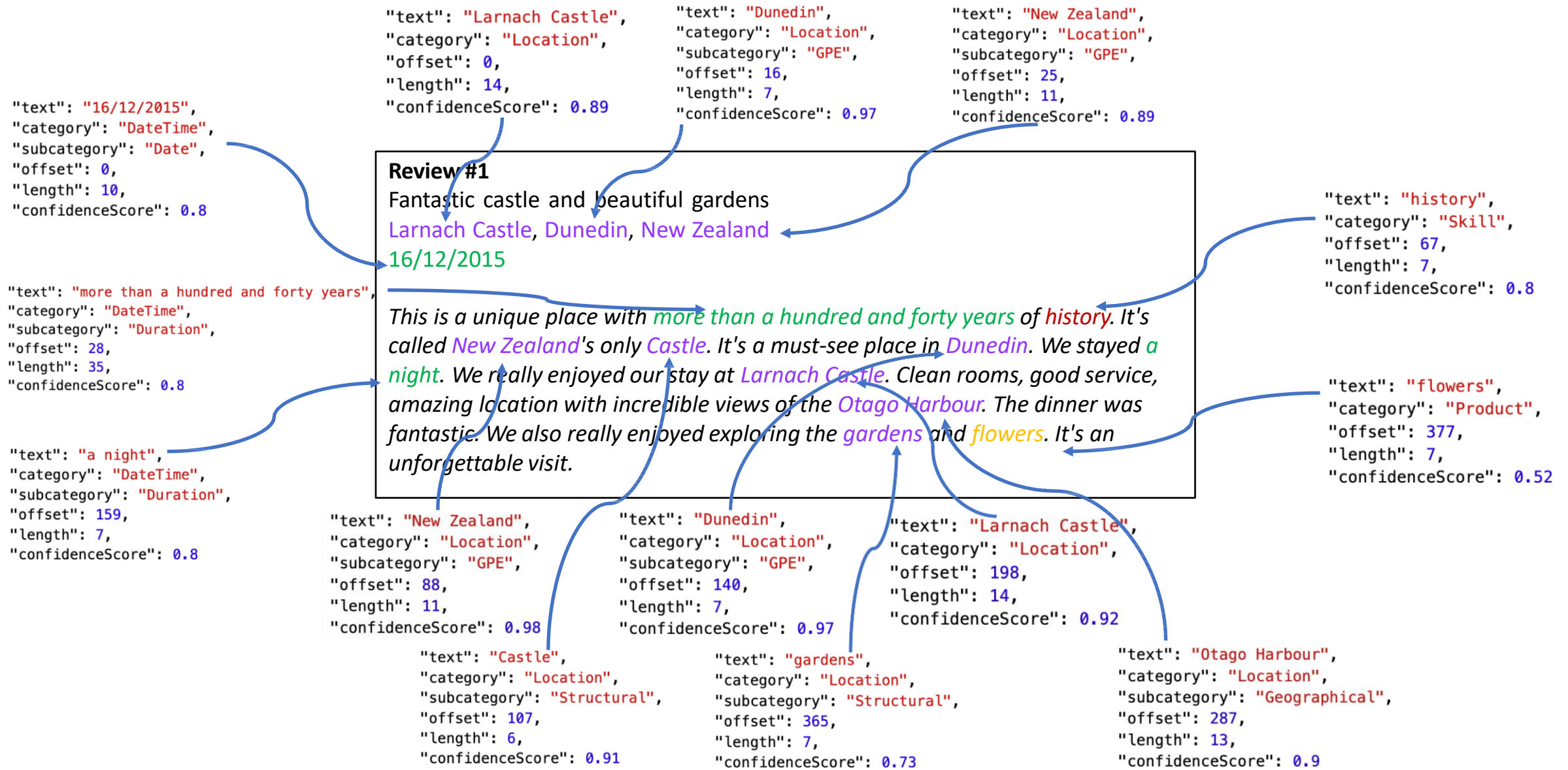
- Location: Larnach Castle (https://en.wikipedia.org/wiki/Larnach_Castle)
- Location: Dunedin (<https://en.wikipedia.org/wiki/Dunedin>)
- Location: New Zealand
- DateTime: 16/12/2015
- DateTime: more than a hundred and forty years
- Location: New Zealand (https://en.wikipedia.org/wiki/New_Zealand)
- DateTime: night
- Location: Otago Harbour (https://en.wikipedia.org/wiki/Otago_Harbour)

Entity Recognition

- **Named Entity Recognition** Category & Subcategories
 - **Person:** Names
 - **PersonType:** Job types or roles
 - **Location**
 - Geopolitical Entity (GPE) / Structural / Geographical
 - **Organization**
 - Medical / Stock exchange / Sports
 - **Event**
 - Cultural / Natural / Sports
 - **Product**
 - Computing products
 - **Skill**
 - **Address**
 - **Phone number** (US and EU phone numbers only)
 - **Email**
 - **URL**
 - **IP**
 - **DateTime**
 - Date / Time / DateRange / TimeRange / Duration / Set
 - **Quantity**
 - Number / Percentage / Ordinal numbers / Age / Currency / Dimensions / Temperature
- **Entity Linking - Wikipedia**
- **Personally Identifiable Information (PII)**
- **Health (PHI) (Preview)**

Text Analytics Service – Entity Recognition Sample

Text Analytics API (v3.1)



Hands-on Lab

Analyzing Text

with

Azure Text Analytics Service



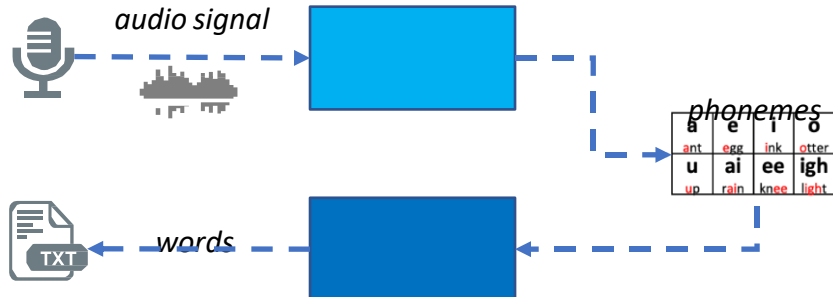
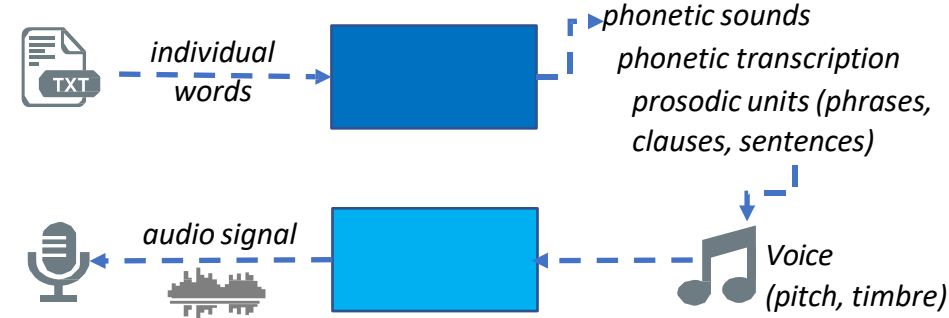
Speech Service



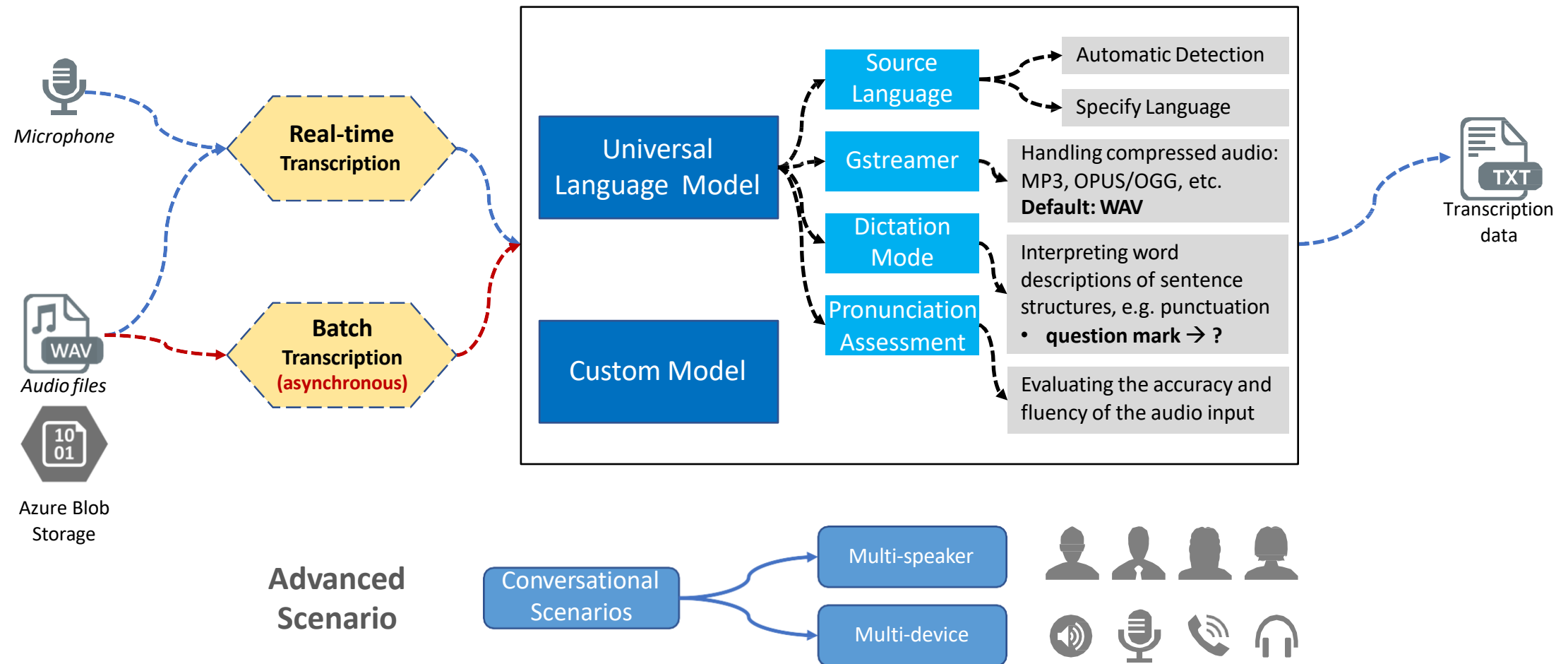
Speech Recognition vs. Speech Synthesis

Speech Recognition

Speech Synthesis

Feature	<ul style="list-style-type: none"> • Detect and interpret spoken input 	<ul style="list-style-type: none"> • Generate spoken output
Input	<ul style="list-style-type: none"> • Recorded voice -- audio file • Live audio -- microphone 	<ul style="list-style-type: none"> • Text to be spoken • Voice to be used to vocalize the speech
Process & Output	 <p>The diagram illustrates the Speech Recognition process. It starts with an 'audio signal' from a microphone icon entering a blue processing box. The output of this box is a grid of 'phonemes' (a, e, i, o, u, ai, ee, igh, up, rain, knee, light). This grid then feeds into a second blue processing box, which outputs 'words' and saves them as a 'TXT' file.</p>	 <p>The diagram illustrates the Speech Synthesis process. It starts with 'individual words' from a 'TXT' file entering a blue processing box. The output of this box is 'phonetic sounds', 'phonetic transcription', and 'prosodic units (phrases, clauses, sentences)'. This output then feeds into a second blue processing box, which produces an 'audio signal' (represented by a waveform icon). This audio signal is then converted into a 'Voice (pitch, timbre)' output, represented by a musical note icon.</p>
Use Cases	<ul style="list-style-type: none"> • Generating captions for recorded or live videos • Creating transcripts of phone calls or meetings • Automating note dictation • Determining user's input for further processing 	<ul style="list-style-type: none"> • Generating spoken responses to user's input • Creating telephone voice menus • Reading email or text messages • Broadcasting announcements in public areas • Creating voices for extinct languages

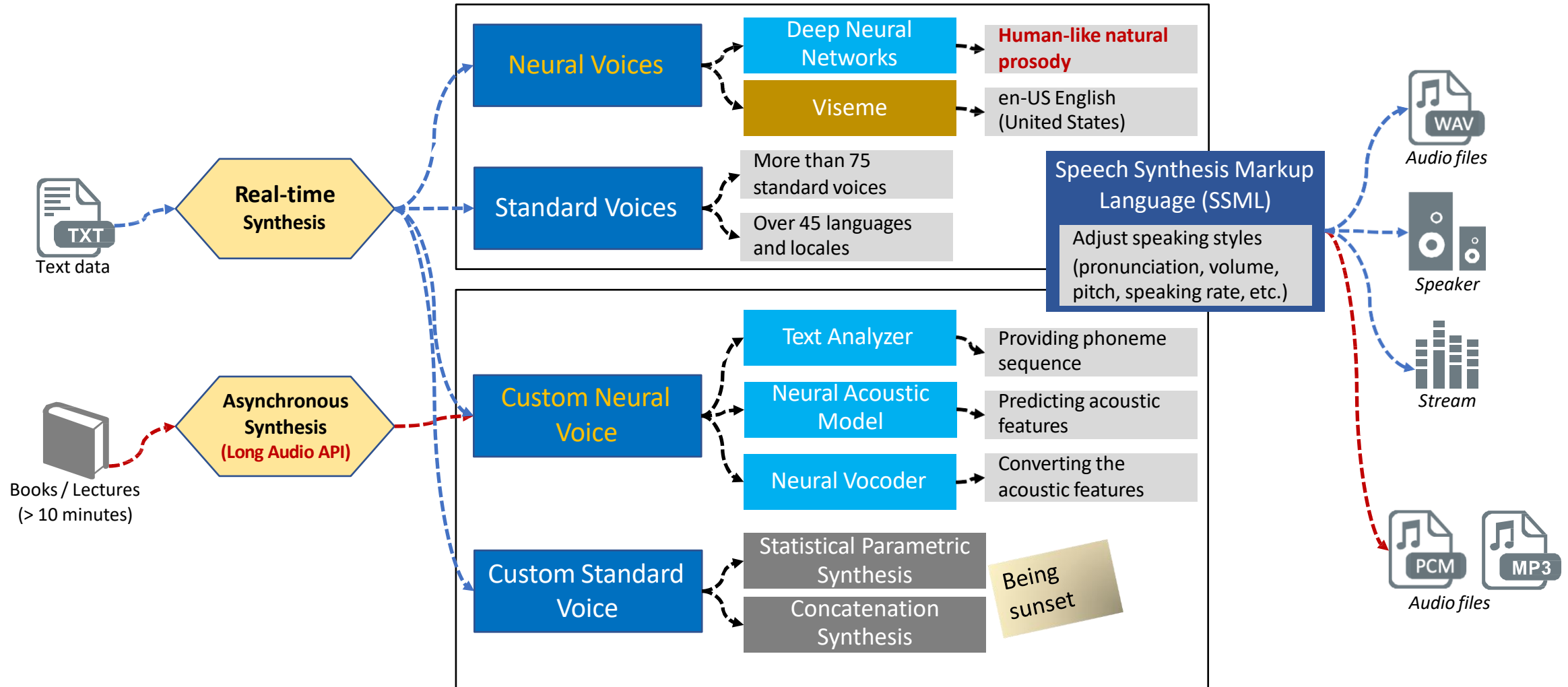
Speech Recognition – Speech-to-Text Service Overview



Language Support:


<https://docs.microsoft.com/en-us/azure/cognitive-services/speech-service/language-support#speech-to-text>

Speech Synthesis – Text-to-Speech Service Overview




Speech Service Samples

Speech-to-Text

Input	Output
	<i>To be or not to be? That is the question. Whether TIS nobler in the mind to suffer the slings and arrows of outrageous fortune, or to take arms against a sea of troubles, and by opposing end them.</i>

Text-to-Speech

Input	Output
<i>To be, or not to be, that is the question: Whether tis nobler in the mind to suffer The slings and arrows of outrageous fortune, Or to take arms against a sea of troubles And by opposing end them.</i>	 Standard Voice

Hands-on Lab

Recognizing & Synthesizing Text

with

Azure Speech Service



Translation Services



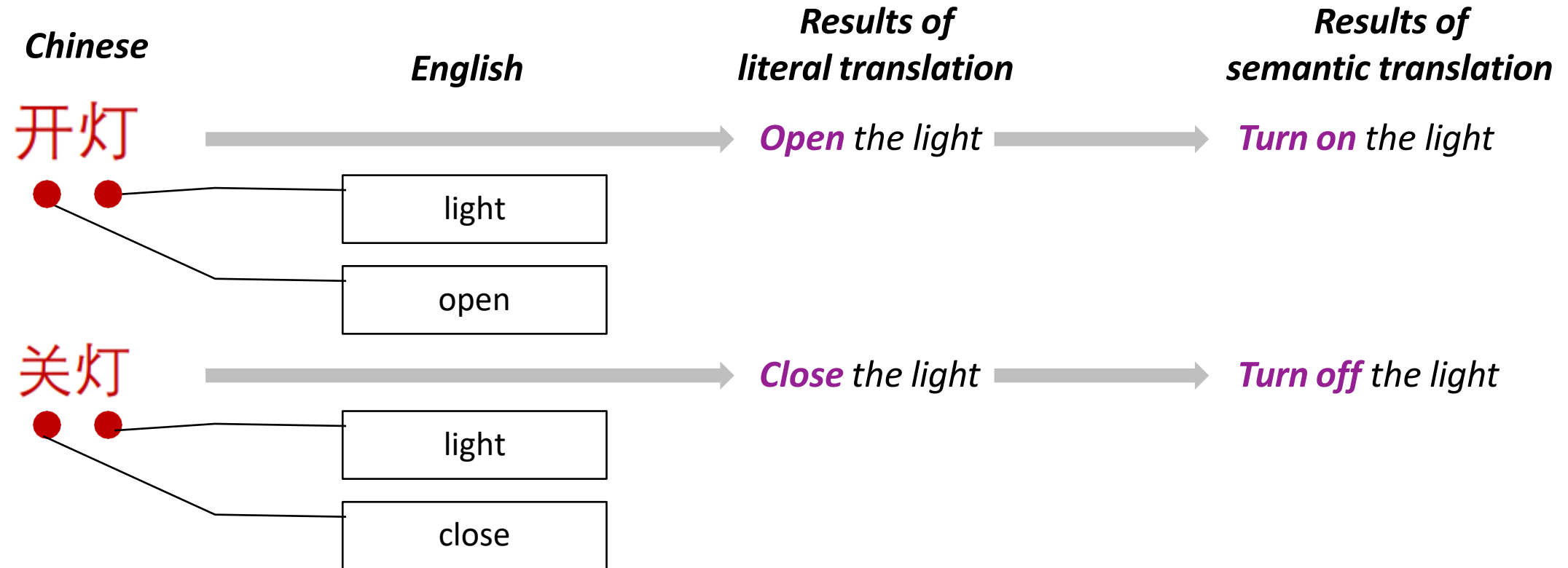
Literal Translation vs. Semantic Translation

- Literal Translation

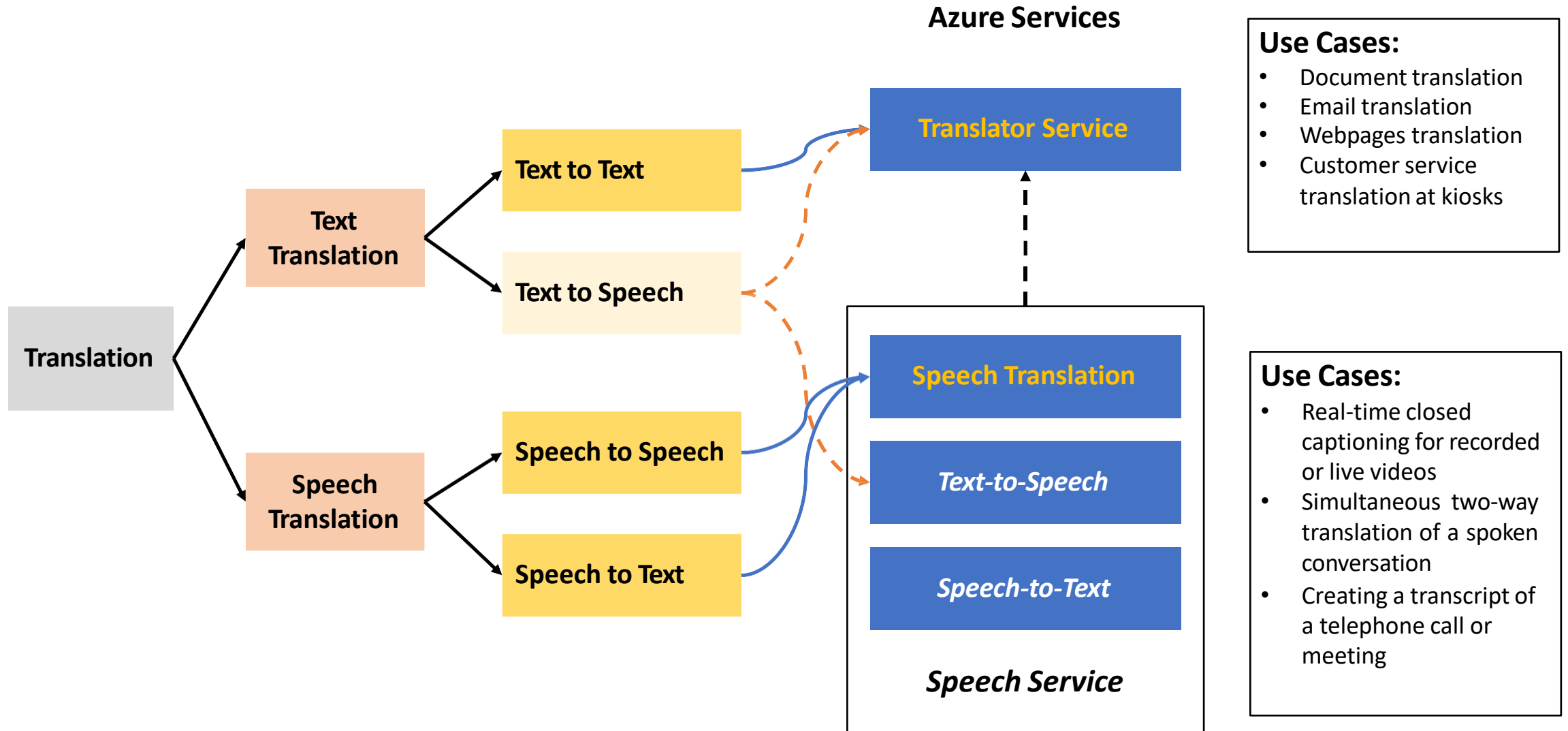
- word-for-word translation

- Semantic Translation

- using semantic context



Translation Services Overview



Translation Services – Translator Service Overview

- **Text-to-text translation**

- Supports **more than 90 languages and dialects**
- **Neural Machine Translation (NMT)** replaces the legacy *Statistical Machine Translation (SMT)*
- Supporting Custom Translator to improve translations, e.g. industry terminology

- **Multiple target languages translation**

- specify one **from** language
- multiple **to** languages

- **Optional Configurations**

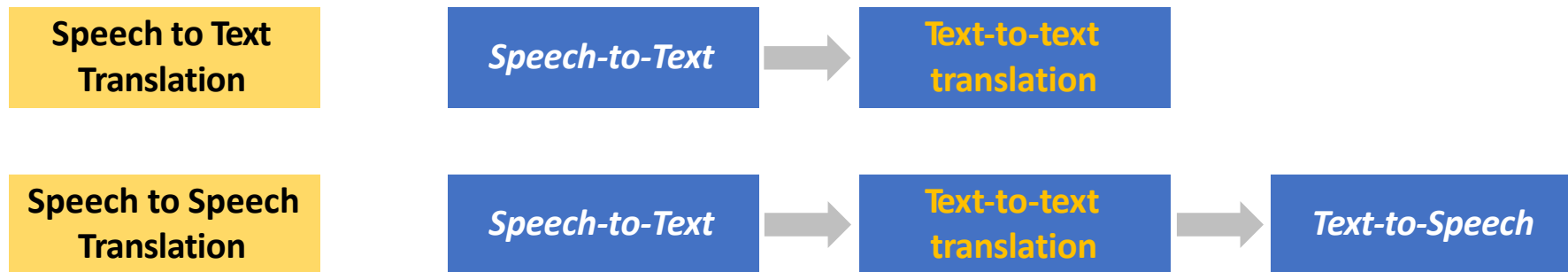
- **Profanity Filtering** - omitting profane text translation (default is disabled)
- **Selective Translation** - content can be tagged so that it isn't translated
 - For example, *brand names*

Language Support:

<https://www.microsoft.com/en-us/translator/business/languages/#list>

Translation Services – Speech Translation Service Overview

- **Speech-to-text translation**
- **Speech-to-speech translation**
- Translating speech to multiple target languages
 - Supports **more than 60 languages and dialects** in real-time
 - **Speech recognition occurs before speech translation**



Translation Services – Translator Service Samples

Source Language

Hello world! AI is the future! -> 世界您好! 人工智能就是未来!

-> Salut tout le monde! L'IA, c'est l'avenir !

Option 1: Specify source

- 'from': 'en-US'

Option 2: Language Detection

Target Language

Option 1: Specify one target each time, translate twice

- 'to': 'zh-CN'
- 'to': 'fr'

Option 2: Specify multiple targets with a comma between the language codes, translate simultaneously

- 'to': 'zh-CN', 'fr'

Hands-on Lab

Translating Text & Speech

with

Azure Translator & Speech Services

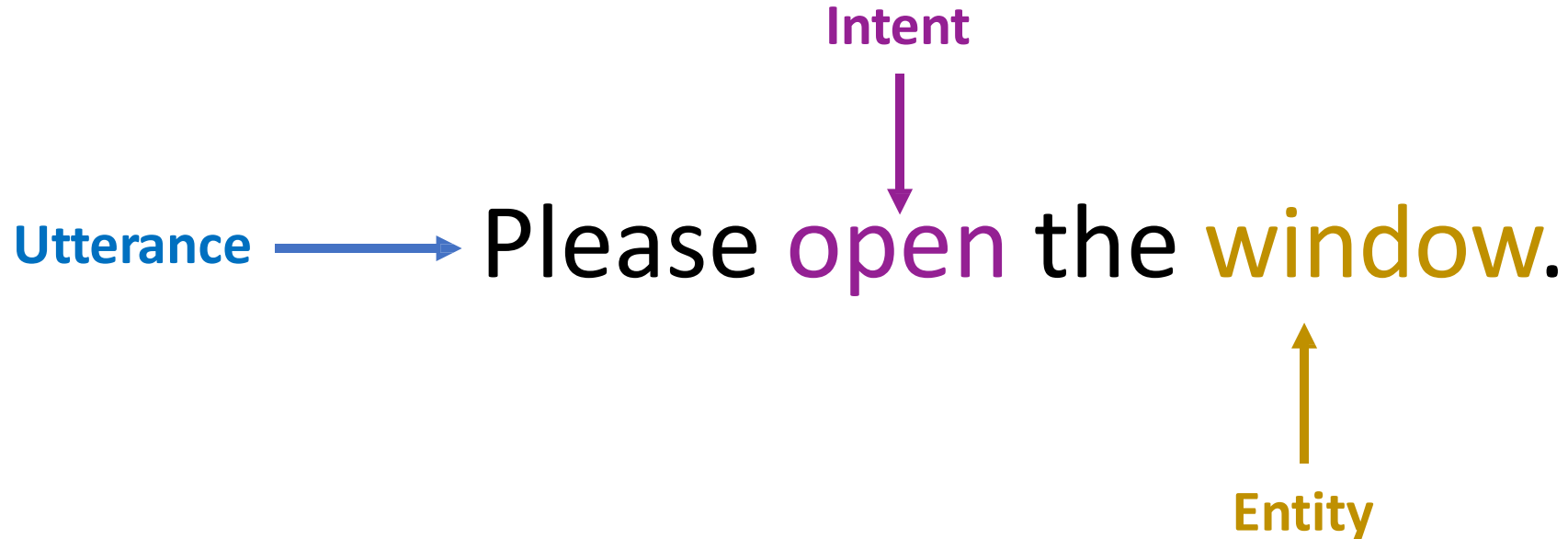


Language Understanding Service (LUIS)

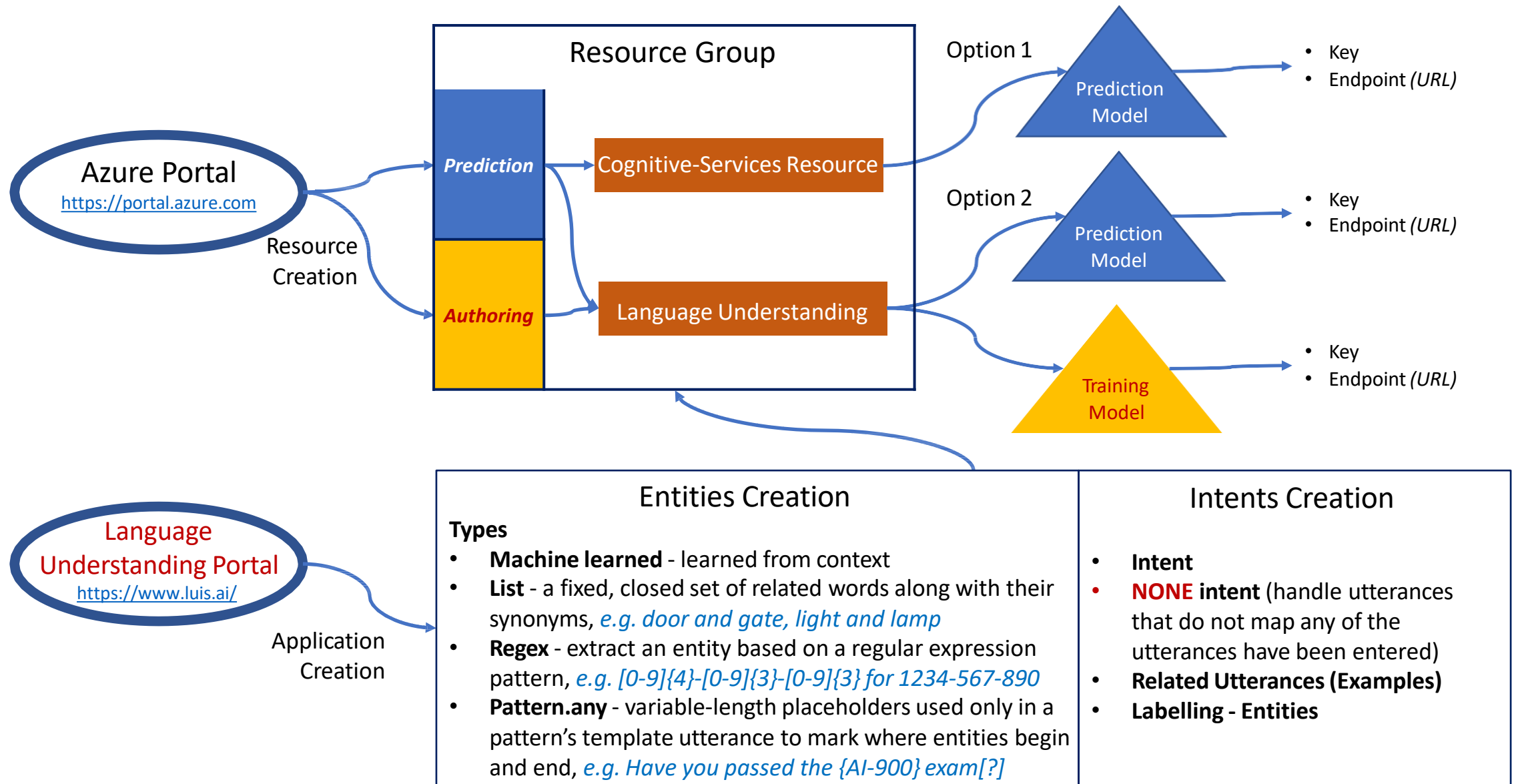


Language Understanding Service – Language Understanding

- **Utterances** – what sentences a user might say
- **Entities** – an item to which an utterance refers
- **Intents** – purpose, goal, or task expressed in an utterance



Language Understanding Service – Resource & App Creation



Language Understanding Service – LUIS Model Building Workflow



Creating Entities

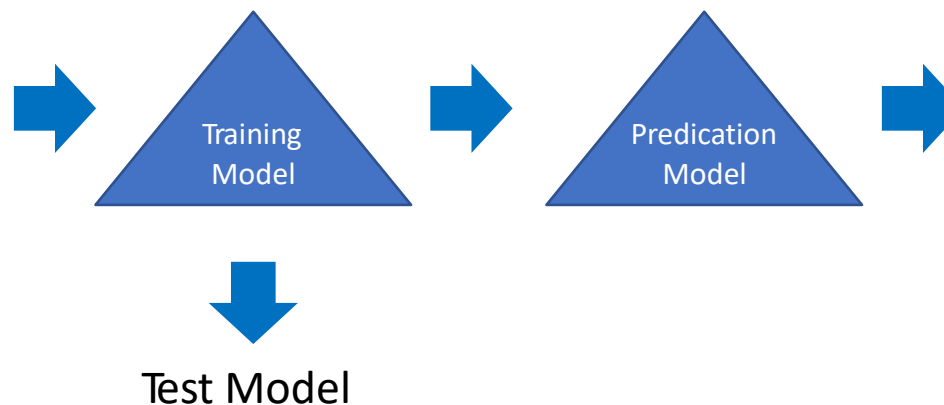
- **Device (Type: List)**

Normalized value	Synonyms
• door	• gate
• light	• lamp
• fan	• AC

Creating Intents

- **None**

• close	→ close the <u>gate</u> device
• open	→ close the <u>door</u> device
• switch_off	→ open the <u>gate</u> device
• switch_on	→ open the <u>door</u> device
	→ turn the <u>fan</u> off device
	→ turn the <u>light</u> off device
	→ turn the <u>fan</u> on device
	→ turn the <u>light</u> on device



- **Project ID**
- **Predication Key**
- **Predication Endpoint**
- **Predication Location**

- * Please open the door
- * Could you open the gate



- * Please close the gate
- * Could you close the door



- * Turn on the light please
- * Please switch the lamp on



- * Turn off the light please
- * Please turn the lamp off



- * Switch on the fan please
- * Please turn the AC on



- * Switch off the fan please
- * Please turn the AC off



Hands-on Lab

Understanding Language

with

Azure Language Understanding Services



Natural Language Processing Summary



NLP Summary

