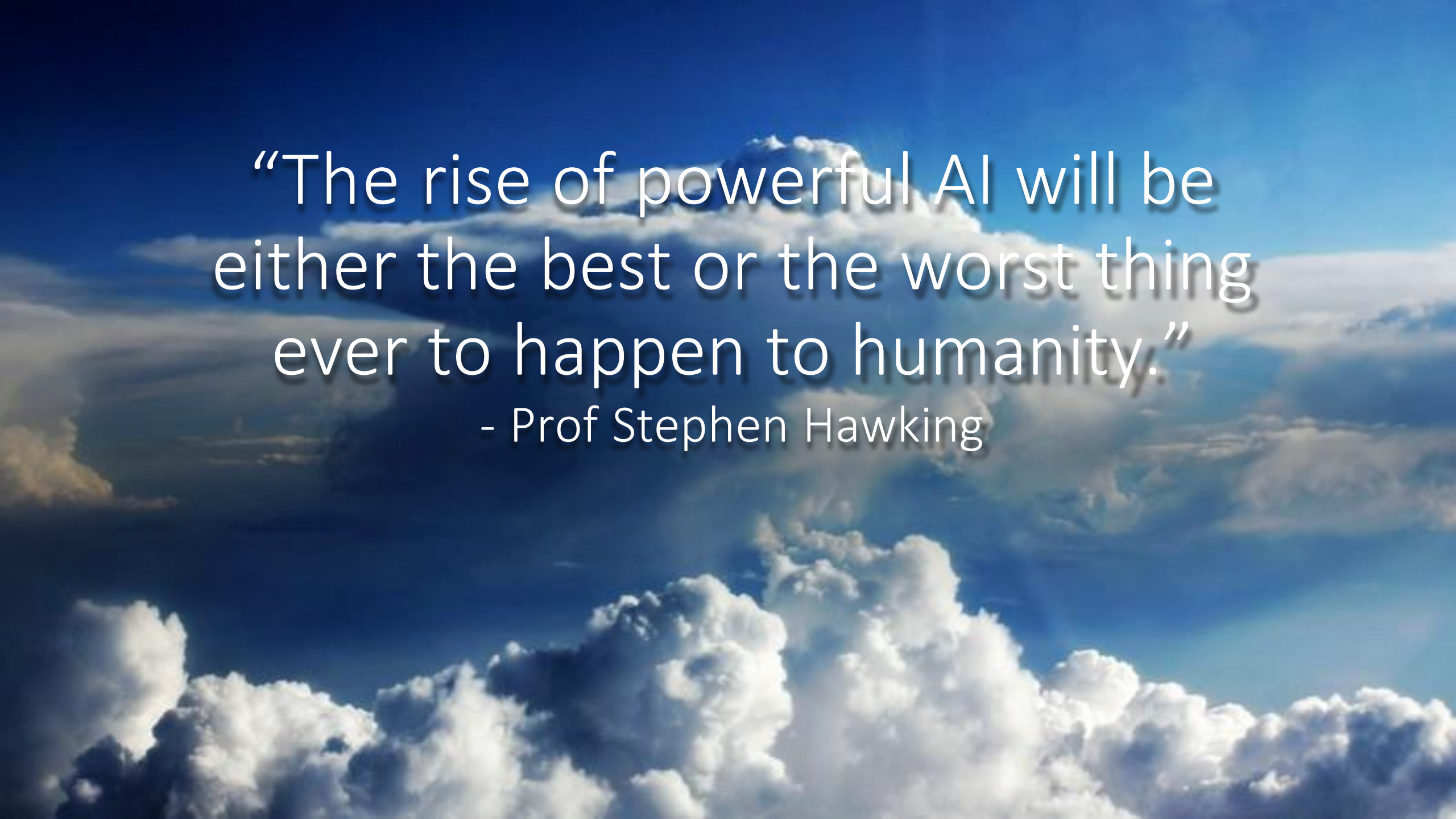
Section 2

Introduction to Artificial Intelligence


“The rise of powerful AI will be either the best or the worst thing ever to happen to humanity.”
- Prof Stephen Hawking

What's Artificial Intelligence (AI) – Definition from dictionaries

- "The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages."

  – *Oxford Dictionary*

- "The study of how to produce machines that have some of the qualities that the human mind has, such as the ability to understand language, recognize pictures, solve problems, and learn"

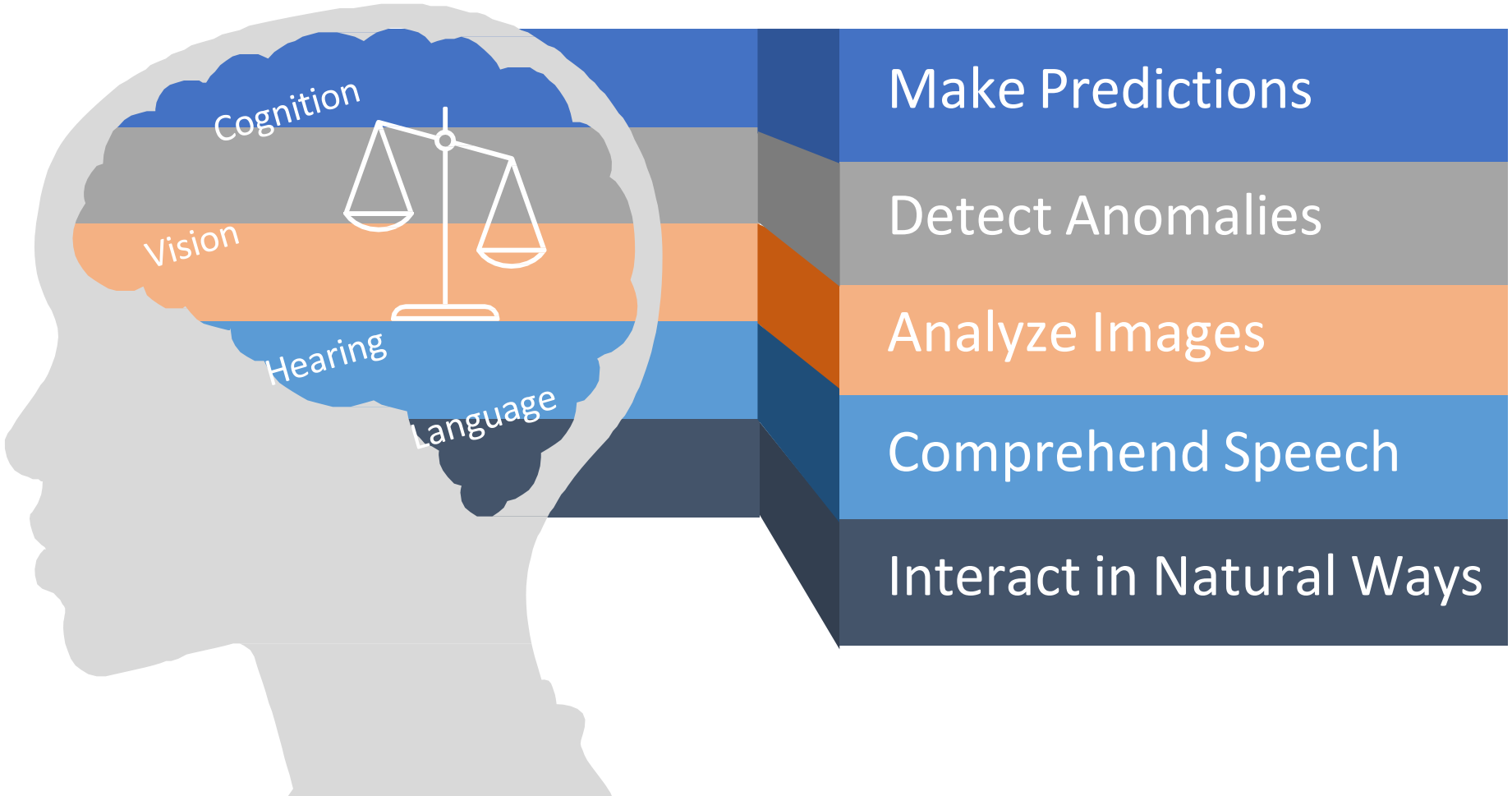
  – *Cambridge Dictionary*

- "The study of how to make computers do intelligent things that people can do, such as think and make decisions"

  – *Longman Dictionary*

What's Artificial Intelligence (AI) – Definition in AI-900

- *Artificial intelligence* (AI) is the capability of a computer to imitate intelligent human behavior.

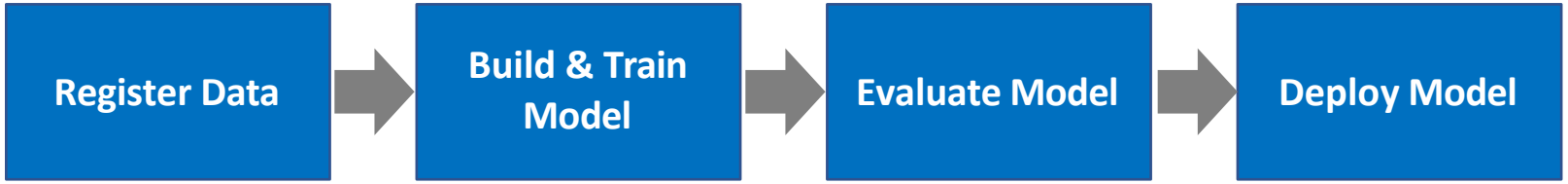


Introduction to Machine Learning

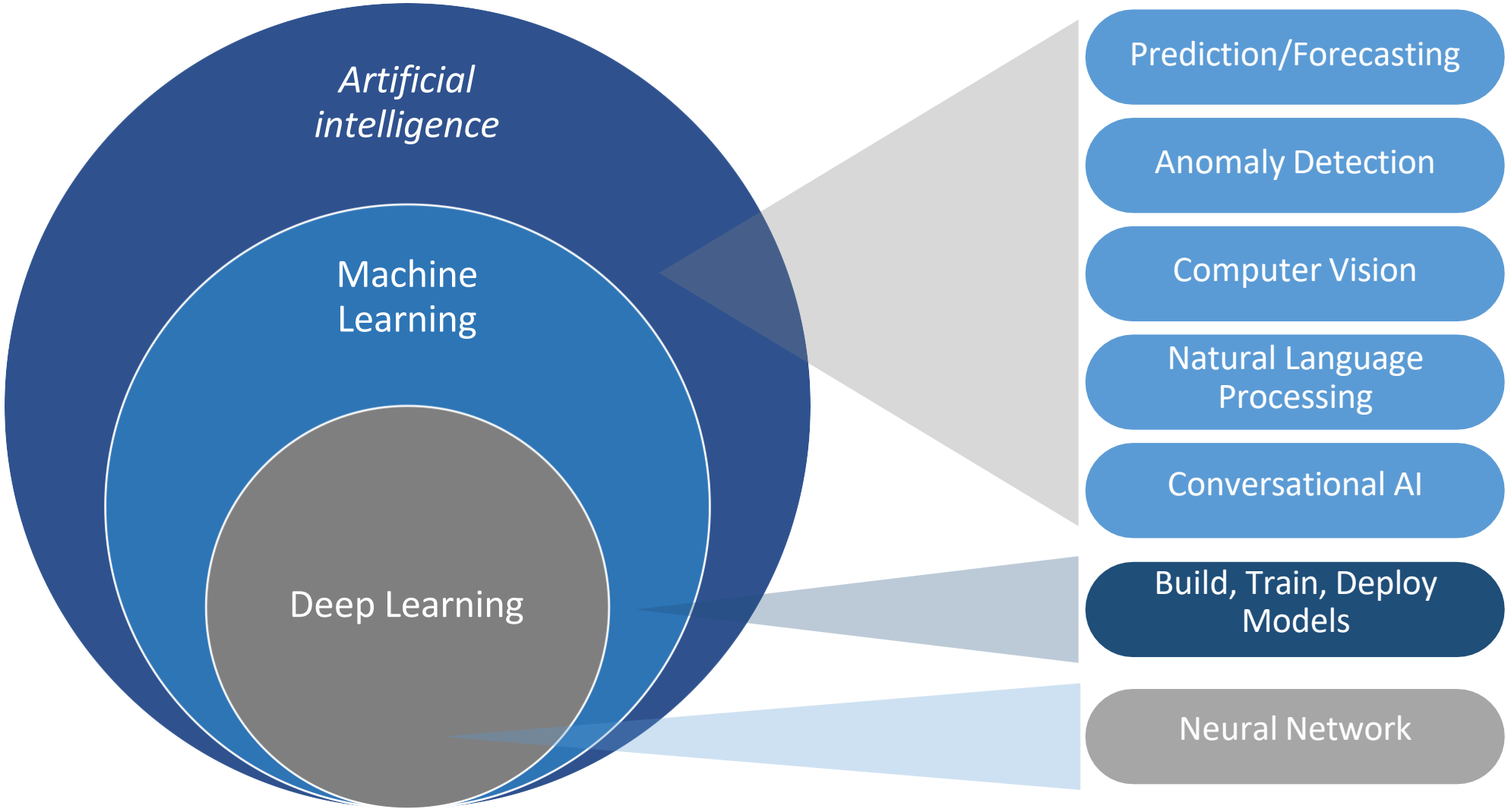
- **Machine Learning**

A data science technique that allows computing resources to use historical data to create a model to forecast future behaviours, outcomes, and trends.

- **Purpose** - Forecasts / Predictions



Machine Learning (ML) is the foundation of an AI system



Common AI Workloads

Prediction/Forecasting in AI

- **Workloads**
  - Prediction of the global growth and trend of COVID-19 pandemic
  - Prediction of a disease diagnosis based on symptoms and medical history
  - Prediction of the future levels of carbon dioxide (CO2) in the atmosphere
  - Weather prediction/forecasting
  - Predict application workload and performance for resource management
  - Predict sales of cars next month based on historic data
  - Predict home prices next year
  - Predict the travel time/fastest route using a navigation app

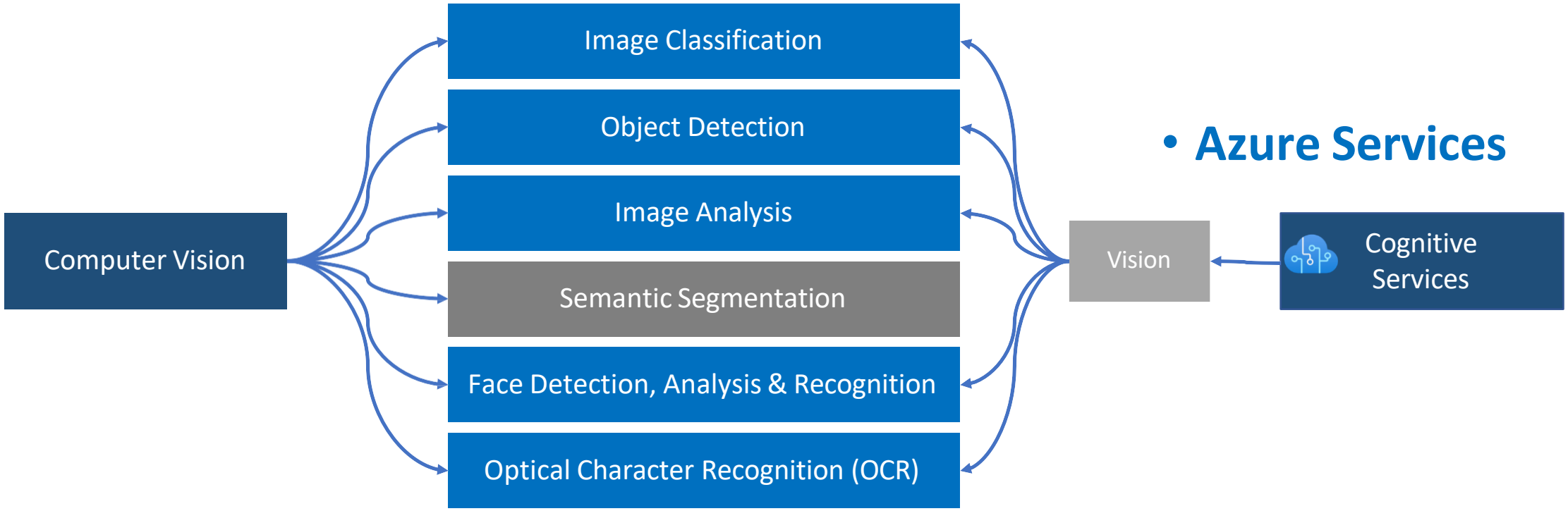
- **Azure Services**
  - Machine Learning

Anomaly Detection in AI

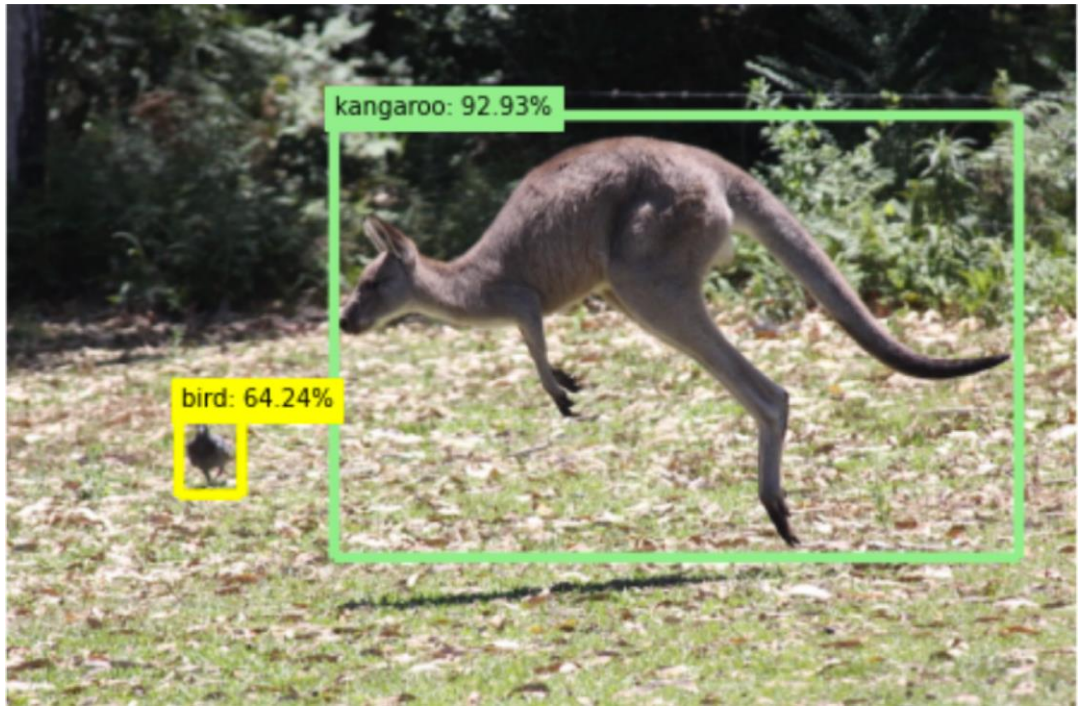
- **Workloads**
  - Identifying suspicious logins by looking for deviations from normal activities
  - Identifying suspicious behaviors by detecting too many failed login attempts
  - Monitoring machines' temperature in the factories
  - Detecting irregular heart beats using a health monitoring system in the hospital
  - Detecting fraud in credit card transactions in the Banking systems

- **Azure Services**

Computer Vision in AI – Overview



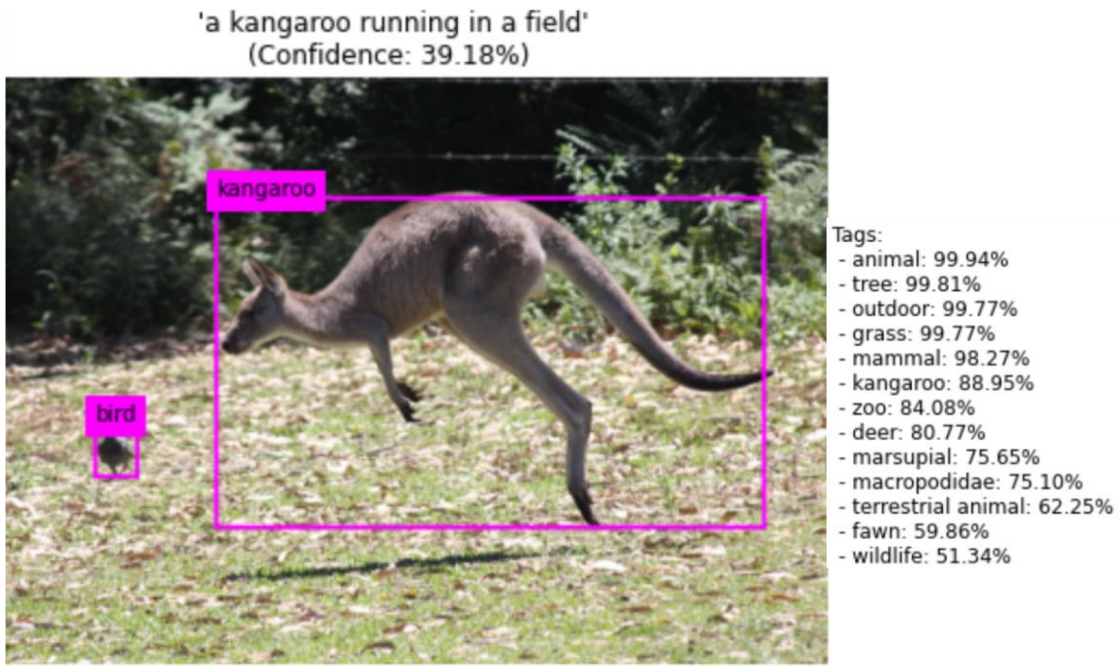
Computer Vision in AI – Image Classification & Object Detection

Image Classification	Object Detection
• Classify images based on contents	• Classify individual objects • Identify object's location • Indicate a bounding box
	

Computer Vision in AI – Image Analysis & Semantic Segmentation

Image Analysis

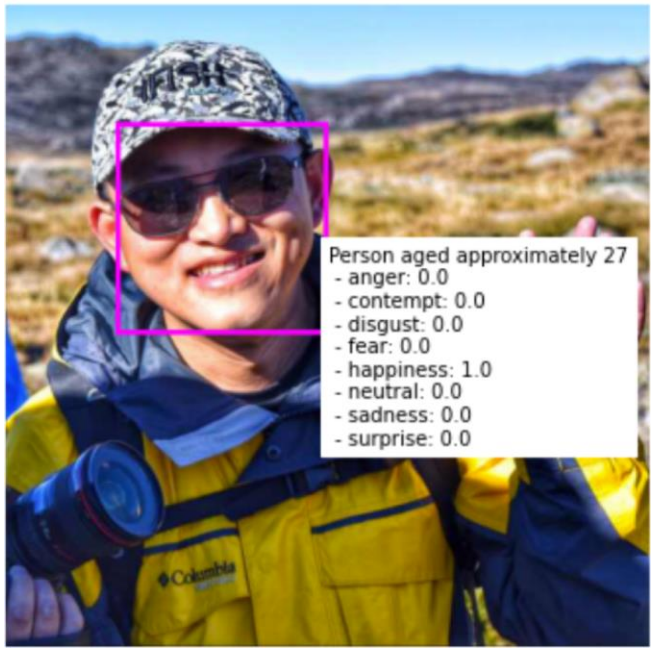
- Extract information from images
- Return 'tags' with 'confidence'
- Summarize the scene with a descriptive caption



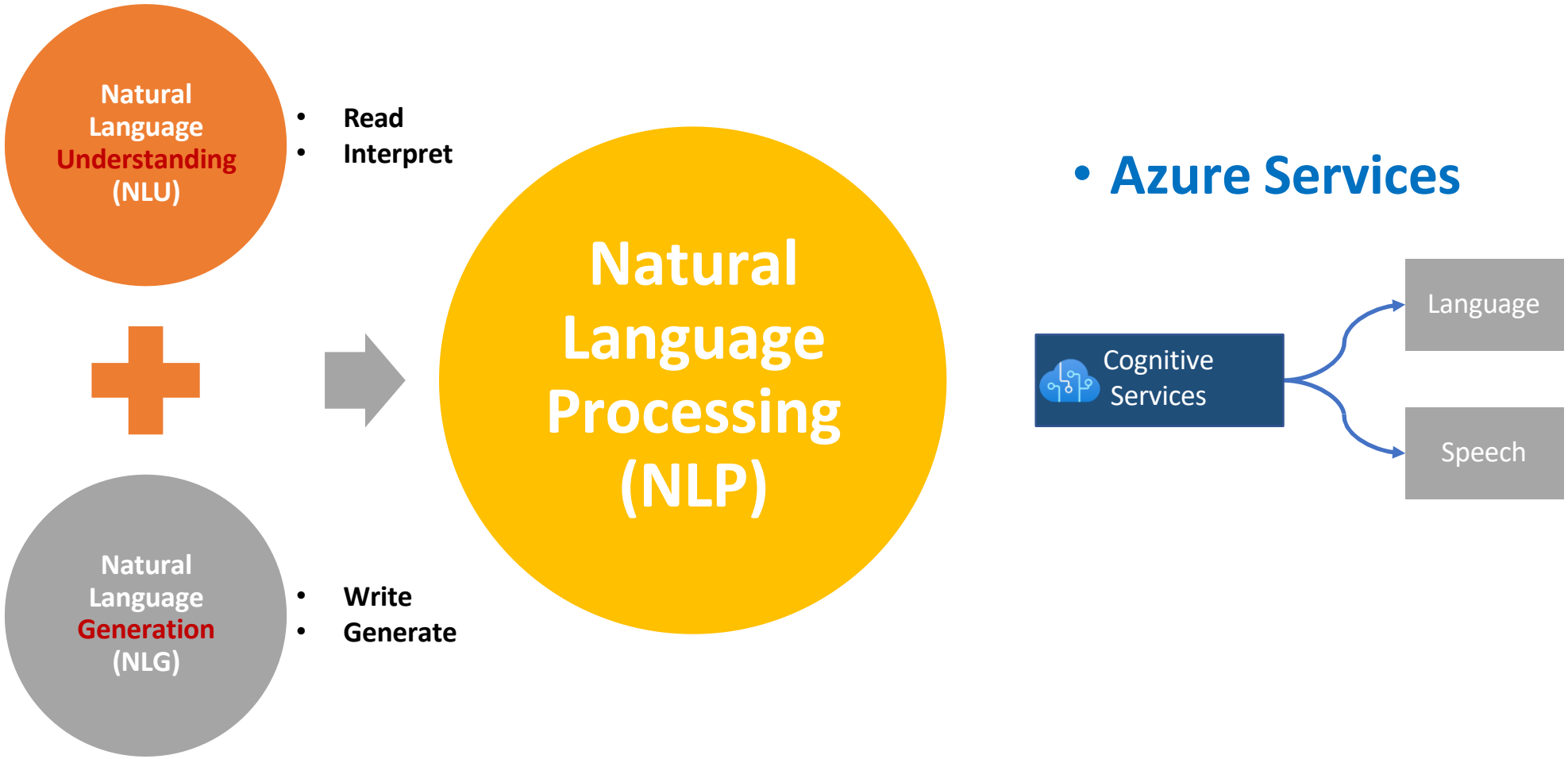
Semantic Segmentation

- An advanced ML technique – label every pixel
- Locate objects and shapes
- Return a mask layer of objects

Computer Vision in AI – Face Detection & OCR

Face Detection, Analysis & Recognition	Optical Character Recognition (OCR)
• Specialized form of object detection • Locate human faces with a bounding box • Suggest age and emotional state • Identify or verify the identity of an individual	• Recognise text in images (photos or scanned documents) • Convert printed or handwritten text characters into text data
(1 faces detected) 	FIRE SAFETY DOOR DO NOT OBSTRUCT DO NOT KEEP OPEN 

Natural Language Processing (NLP) in AI



Natural Language Processing (NLP) in AI – NLU

Text Interpretation

- Analyze and interpret text in documents

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

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

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

Determine Sentiment

```
Document Sentiment: positive
Overall scores: positive=0.96; neutral=0.04; negative=0.00
```

Extract Known Entities

```
- 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)
```

Speech Recognition

- Interpret spoken language

Audio → **Text**

"Hello everyone."

"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."

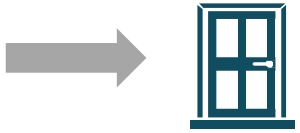
Natural Language Processing (NLP) in AI – Intent Recognition

Commands Interpretation / Intent Recognition

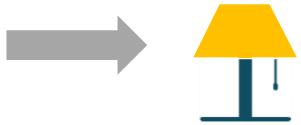
- Interpret commands and determine appropriate actions

* Please open the door
* Could you open the gate

* Please close the gate
* Could you close the door



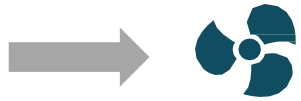
* Turn on the light please
* Please switch the lamp on

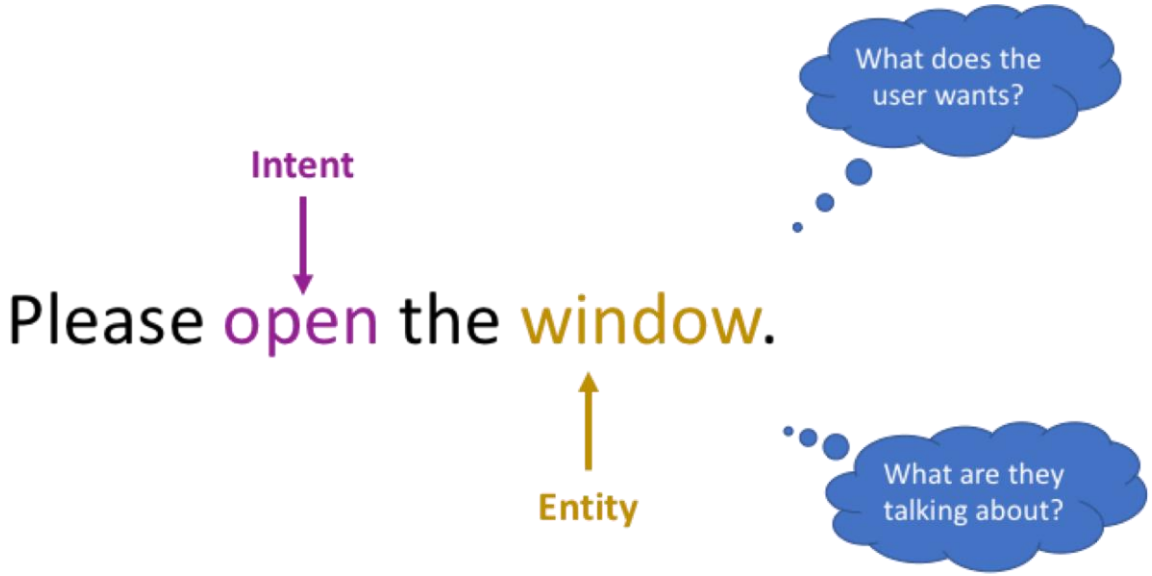


* Turn off the light please
* Please turn the lamp off

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

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





Natural Language Processing (NLP) in AI - NLG

Speech Synthesis

- Synthesize speech responses

Text → **Audio**

"Turning the light off."

"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."

Translation

- Translate spoken or written texts

English to French:

Text Translation

Text to Text — Hello -> Bonjour

Text to Speech — Hello -> 

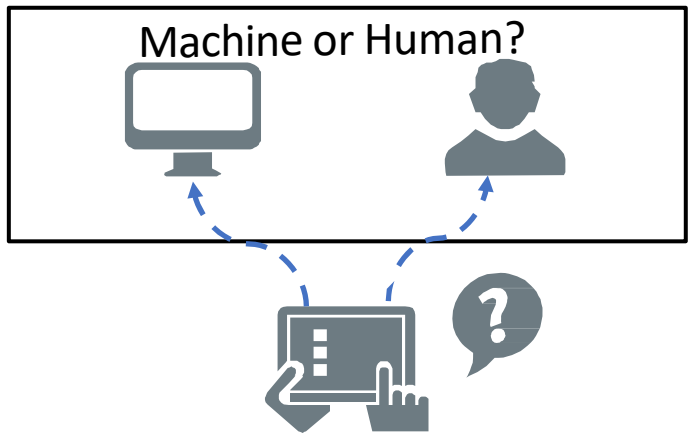
Speech Translation

Speech to Speech —  -> 

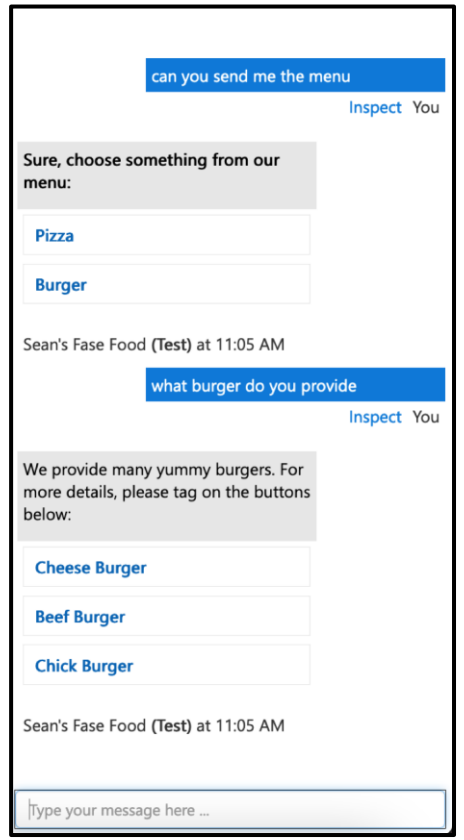
Speech to Text —  -> Hello -> Bonjour

Conversational AI

- AI agents participate in conversations with humans
- **Conversation AI Scenarios**
  - Chatbots
    - *IBM Watson Assistant*
  - Home automation / Smart home
  - Smart personal assistant / Virtual assistants
    - *Siri, Alexa, Google Assistant, Cortana, etc.*
- **Turing Test**

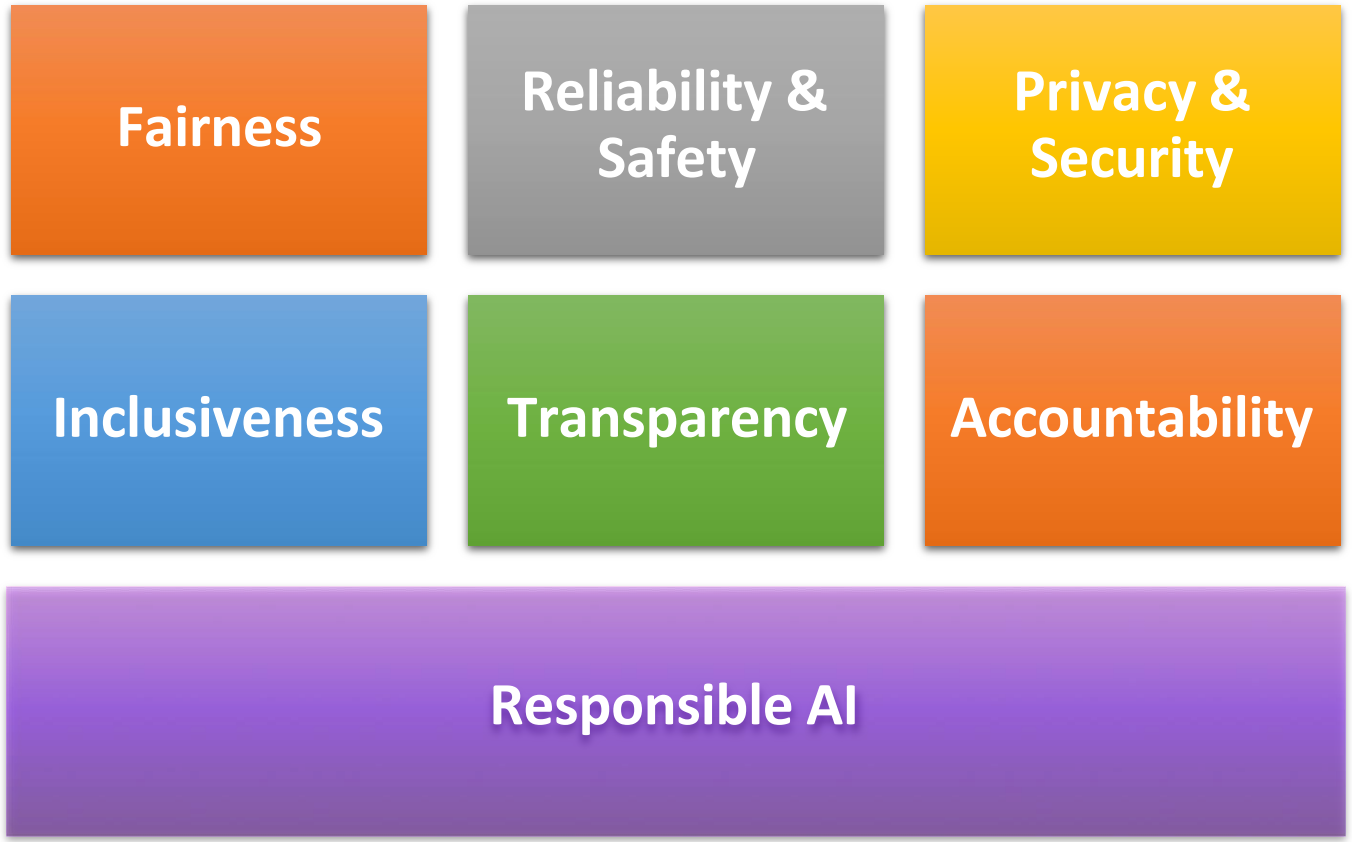


- **Azure Services**
  - QnA Maker
  - Bot Services



Principles of Responsible AI

Six Ethics Principles of Microsoft Responsible AI



To build a trust, reliable, safe and secure AI

Ethics Principles of Responsible AI

Treat all people fairly

Scenarios

- AI based Supermarket Surveillance
- AI based banking home Loan application
- AI based interview application

Ethics Principles of Responsible AI

Perform reliably and safely

Scenarios

- Operate as the intended purpose
- Handling of unexpected circumstances
- Handling of missing data/unusual input
- Handling of corruption of system
- Safety of self-driving cars

Ethics Principles of Responsible AI

Secure and respect privacy

Scenarios

- Run the model locally without storing data
- Prevent data leakage
- Data Anonymization
- Implement security measures

Ethics Principles of Responsible AI

Empower everyone and engage people

Scenarios

- Include people who have vision and hearing impairment
- Avoid any specific individual, user groups or communities being left out

Ethics Principles of Responsible AI

Be understandable

Scenarios

- Clear the purpose of the AI system
- Explain how the AI system operates
- Understand the behaviors
- Ensure users are aware of the limitation of the system

Ethics Principles of Responsible AI

People should be accountable for AI systems

Scenarios

- Designers and developers work within a framework of governance and organizational principles
- Make company policies clear and accessible to design and development teams
- Ensure the systems meet ethical and legal standards
- AI systems can be overridden by humans

Artificial Intelligence Summary

Azure AI + ML Services in AI-900