

1. Language Name, ISO 6391 Code, and Score are three values returned by the Language service of natural language processing (NLP) in Azure.
2. Entity Linking, PII detection, and sentiment analysis are all elements of the Azure AI Service for Azure AI Language.
3. Vectorization captures semantic relationships between words by assigning them to locations in n-dimensional space. Lemmatization, also known as stemming, normalizes words before counting them. Frequency analysis counts how often a word appears in a text. N-grams extend frequency analysis to include multi-term phrases.
4. You use Azure Machine Learning designer to publish an inference pipeline.
5. Which two parameters should you use to access the web service?**C. the authentication keyD. the REST endpoint**
6. Named Entity Recognition (NER) is a Text Analytics service that helps identify entities in the text and group them into different entity categories, like person, organization, location, event, etc.
7. There are three main performance metrics for the Custom vision models: **Precision, Recall, and Average Precision (AP)**.
8. For regression models Evaluate Model module provides the following five metrics: Mean absolute error (MAE), Root mean squared error (RMSE), Relative absolute error (RAE), Relative squared error (RSE), and Coefficient of determination (R2).
9. Microsoft gives us several different flavors of compute at the moment:**Compute instances, Compute clusters, Inference clusters, Attached compute**
10. What are the three main authoring tools on the Azure ML Studio home screen?
Notebooks, Automated ML and Designer.
11. **Utterances** are used to train and test a Language Understanding app model.
12. The **Azure AI Language Studio** provides the easiest way to create a knowledge base for Azure Bot Service.
13. The computer vision service eliminates the need for **choosing, training, and evaluating** a model by providing pre-trained models.
14. **Face identification** in the Azure AI Face service can address **one-to-many** matching.
15. **Face verification** has the capability for **one-to-one** matching.

Performance/Evaluation Metrics are used to evaluate different Machine Learning Algorithms

- Classification (Accuracy, F1 Score, Precision, Recall)
- Regression Metrics (MSE, RMSE MAE)

AI-900 CheatSheet

Exam Pro

Cognitive Services is an umbrella AI service that enables customers to **access multiple AI services** with an **API key and an API Endpoint**

Decision

- **Anomaly Detector** — Identify potential problems early on.
- **Content Moderator** — Detect potentially offensive or unwanted content.
- **Personaliser** — Create rich, personalised experiences for every user.

Language

- **Language Understanding** — Build natural language understanding into apps, bots and IoT devices.
- **QnA Maker** — Create a conversational question and answer layer over your data.
- **Text Analytics** — Detect sentiment, key phrases and named entities.
- **Translator** — Detect and translate more than 90 supported languages.

Speech

- **Speech to Text** — Transcribe audible speech into readable, searchable text.
- **Text to Speech** — Convert text to lifelike speech for more natural interfaces.
- **Speech Translation** — Integrate real-time speech translation into your apps.
- **Speaker Recognition** — Identify and verify the people speaking based on audio.

Vision

- **Computer Vision** — Analyze content in images and video.
- **Custom Vision** — Customize image recognition to fit your business needs.
- **Face** — Detect and identify people and emotions in images.

Knowledge mining is a **discipline** in AI that uses a **combination of intelligent services to quickly learn from vast amounts of information**.

- **Ingest** content from a range of sources, using connectors to first and third-party data stores.
- **Enrich** the content with AI capabilities that let you extract information, find patterns, and deepen understanding.
- **Explore** the newly indexed data via search, bots, existing business applications, and data visualizations.



AI-900 CheatSheet

Exam Pro

Microsoft AI Principles (Responsible AI)

1. Fairness — AI systems should treat all people fairly
2. Reliability and Safety — AI systems should perform reliably and safely
3. Privacy and Security — AI systems should be secure and respect privacy
4. Inclusiveness — AI systems should empower everyone and engage people
5. Transparency — AI systems should be understandable
6. Accountability — People should be accountable for AI systems

Common ML Workloads:

- **Anomaly Detection** is the process of finding outliers within a dataset called an **anomaly**
- **Computer Vision** is when we use ML NN to gain high-level understanding from digital images or video
- **Natural Language Processing (NLP)** is ML that can understand the context of a corpus (a body of related text).
- **Conversational AI** is technology that can participate in conversations with humans.



AI-900 CheatSheet

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Azure Machine Learning Service allows you to provision an ML studio to build and maintain ML models and pipelines

Author

- Notebooks — Jupyter Notebooks, an IDE to write python code to build ML models
- AutoML — Completely automated process to build and train an ML model
- Designer — Visual drag and drop designer to construct end to end ML pipelines

Assets

- Datasets — data that you upload which will be used for training. Datasets can be versioned
 - Open DataSets are publicly hosted datasets that are commonly used for learning how to build ML models
- Experiments — Experiments are logical grouping of runs.
 - Runs are ml tasks that performed on virtual machines or containers
- Pipelines — ML workflows you have built, or you have used in the Designer
 - Training Pipeline — pipelines to build and train an ml model
 - Inference Pipeline — pipelines that use a trained model to make prediction on real data.
- Models — a model registry containing trained models that can be deployed
- Endpoints — when you deploy a model its hosted on an accessible endpoint eg. REST API
 - Real-time Endpoint — Invokes an ML model for inference
 - Pipeline Endpoint — Invoke the running on a Pipeline eg. CI/CD

Manage

- Compute — the underlying computing instances used to for notebooks, training, inference
 1. Compute Instances — Development workstations that data scientists can use to work with data and models.
 2. Compute Clusters — Scalable clusters of virtual machines for on-demand processing of experiment code.
 3. Inference Clusters — Deployment targets for predictive services that use your trained models.
 4. Attached Compute — Links to existing Azure compute resources, such as Virtual Machines or Azure Databricks clusters.



AI-900 CheatSheet

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- Environments — a reproducible Python environment for machine learning experiments

Datastores — securely connect to your storage service on Azure without putting your authentication credentials

- Azure Blob Storage, Azure File Share, Azure Data Lake Storage (Gen 2), Azure SQL database, Azure Postgres/MySQL database
- Data Labeling — have humans with ML-assisted labeling to label your data for supervised learning
 - Human-in-the-loop labeling
 - Machine-learning-assisted data labeling
- Linked Services — external services you can connect to the workspace eg. Azure Synapse Analytics

Text Analytics

- sentiment analysis find out what people think of your brand or topic
 - Labels include negative, positive, mixed or neutral
 - Confidence scores ranging from 0 to 1
- opinion mining granular information about the opinions related to aspects
 - granular data with a Subject and Opinion tied to a Sentient
- key phrase extraction quickly identify the main concepts in text.
- language detection detect the language an input text is written in
- named entity recognition (NER) — detects words and phrases mentioned in unstructured text that can be associated with one or more semantic types.



Language Understanding (LUIS) is a no-code ML service to build natural language into apps, bots, and IoT devices

- Natural Language Understanding (NLU) the ability to transform a linguistic statement to a representation that enables you to understand your users naturally
 - LUIS key schema components
 - **intentions** — what the user is asking for
 - a LUIS app always contains a **None** Intent
 - **entities** — what parts of the intent is used to determine the answer
 - **utterances** — Examples of user input that includes intent and entities to train the ML model to match predictions against real user input
- QnA Maker generate a bot from a URL, PDF or DOX
- multi-turn conversation – follow up prompts to narrow to a specific answer
 - Chit-chat — personalized canned responses
- Azure Bot Service — allows you to host bots
- Bot Framework SDK — an end-to-end SDK to ~~design, build, test, publish, connect and evaluate bots~~
 - Box Framework Composer — a desktop application to design bots, leverages the ~~Box Framework SDK~~



AZURE Cognitive services:



Azure Cognitive Services

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Decision

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Knowledge Mining:

Knowledge Mining

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Knowledge mining is a **discipline** in AI that uses a **combination of intelligent services** to quickly learn from vast amounts of information.

It allows organizations to deeply understand and easily explore information, uncover hidden insights, and find relationships and patterns at scale.

Ingest	Enrich	Explore
Structured • Databases • CSV	Cognitive Services • Vision • Language • Speech • Decision • Search	Enrich, Structured Data • Customer relationship management (CRM) • RAP Systems • Power BI
Unstructured • PDF, Video, Image, Audio		
Ingest content from a range of sources, using connectors to first and third-party data stores.	Enrich the content with AI capabilities that let you extract information, find patterns, and deepen understanding.	Explore the newly indexed data via search, bots, existing business applications, and data visualizations.

Use Cases:

Azure AI Fundamentals Certification (AI-900) - Full Course to PASS the Exam

Knowledge Mining – Use Cases

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Content research
When organizations task employees to review and research of technical data, it can be tedious to read page after page of dense text. Knowledge mining helps employees quickly review these dense materials.

```
graph LR; subgraph Ingest [Ingest]; D[Documents] --> P1[Printed text recognition]; D --> P2[Key phrase extraction]; D --> P3[Shaper skill]; D --> P4[Technical key-word sanitation]; D --> P5[Format definition miner]; D --> P6[Large scale vocabulary matcher]; end; subgraph Enrich [Enrich]; P1 --> S[Search index]; P2 --> S; P3 --> S; P4 --> S; P5 --> S; P6 --> S; end; subgraph Explore [Explore]; S --> SL[Searchable reference library]; end;
```

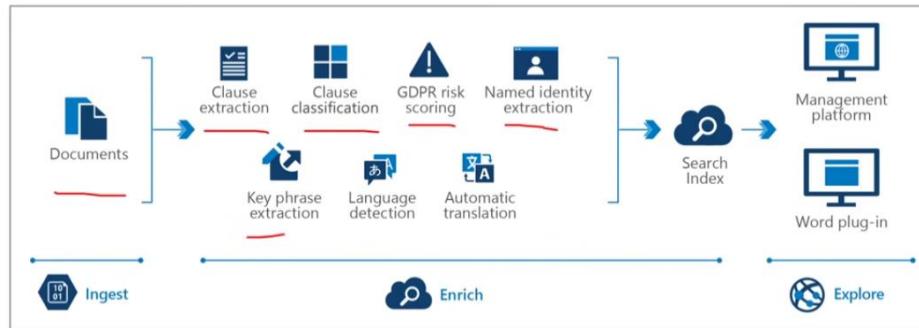
1:02:51 / 4:06:57 • Knowledge Mining >

Knowledge Mining – Use Cases

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Auditing, risk, and compliance management

Developers could use knowledge mining to help attorneys quickly identify entities of importance from discovery documents and flag important ideas across documents.



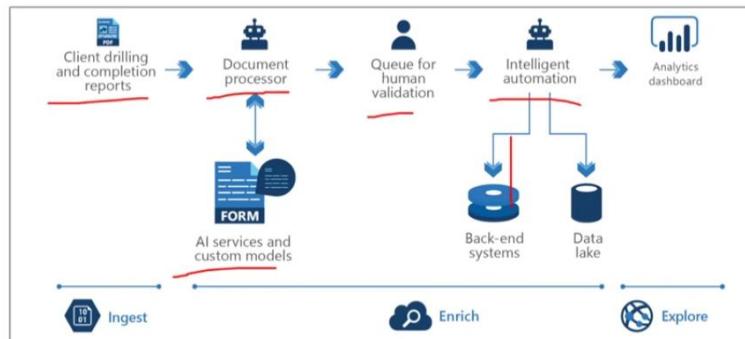
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Knowledge Mining – Use Cases

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Business process management

In industries where bidding competition is fierce, or when the diagnosis of a problem must be quick or in near real-time, companies can use knowledge mining to avoid costly mistakes.



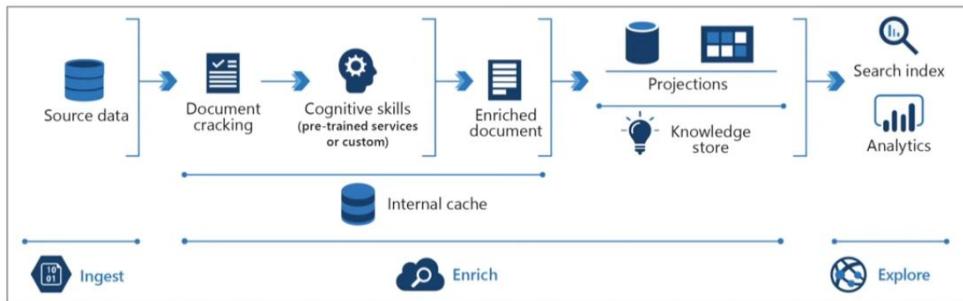
 [Subscribe](#)

Knowledge Mining – Use Cases

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Customer support and feedback analysis

For many companies, customer support is costly and inefficient. Knowledge mining can help customer support teams quickly find the right answer for a customer inquiry or assess customer sentiment at scale.



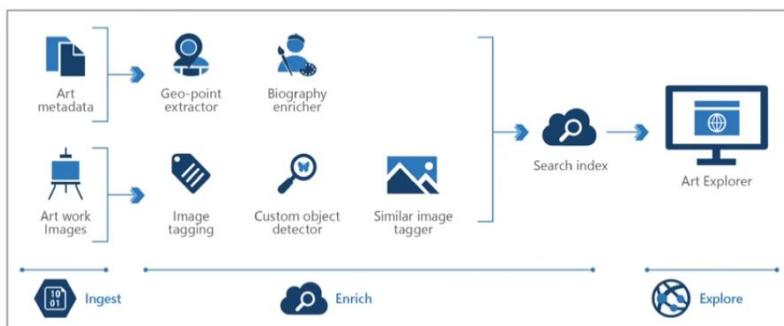
 [Subscribe](#)

Knowledge Mining – Use Cases

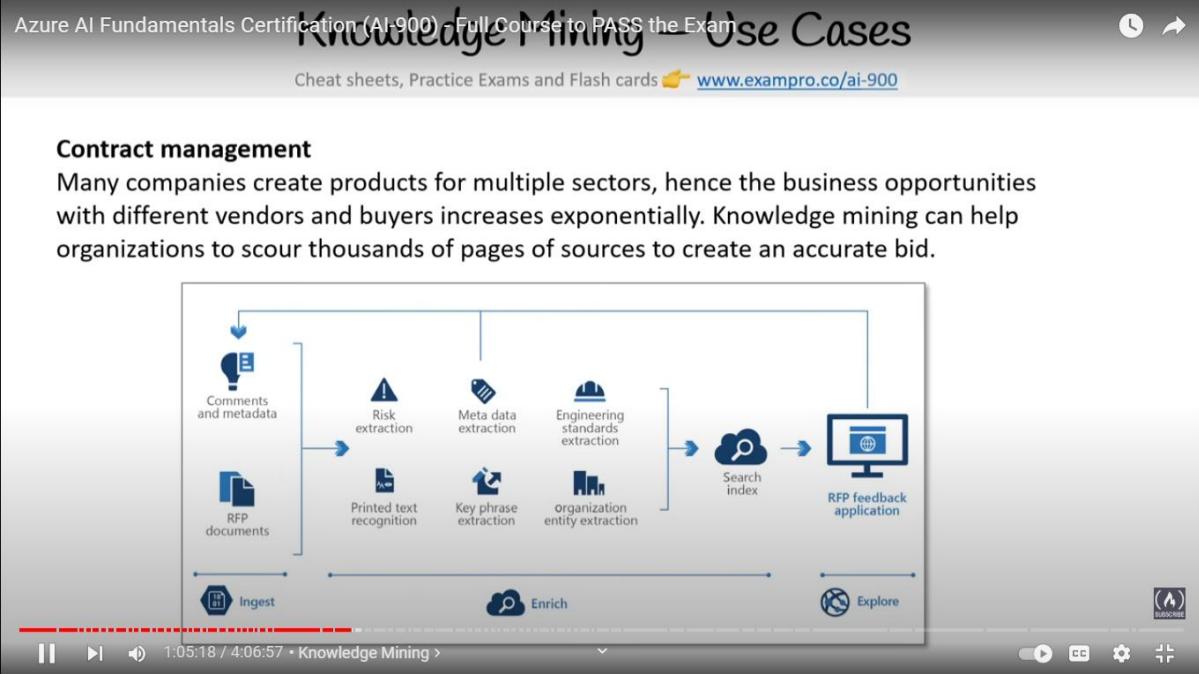
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Digital asset management

Given the amount of unstructured data created daily, many companies are struggling to make use of or find information within their files. Knowledge mining through a search index makes it easy for end customers and employees to locate what they are looking for faster.



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FACE SERVICE:

Face Service

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Azure Face service provides AI algorithms that **detect, recognize, and analyze human faces** in images

Azure Face can detect:

- faces in an image
- faces with specific attributes
- face landmarks
- similar faces
- the same face as a specific identity across a gallery of images

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Azure AI Fundamentals Certification (AI-900) - Full Course to PASS the Exam

Face Service

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Watch later

(1 faces detected)

Face ID: a28alpha3-f135-404b-8628-97a92d7216e4

Face ID
unique identifier string for each detected face in an image

Face Landmarks
easy-to-find points on a face
27 predefined landmark points.

EyebrowLeftInner, EyebrowLeftOuter, EyeLeftTop, PupilLeft, EyeLeftOuter, EyeLeftBottom, EyeLeftInner, NoseTip, NoseLeftAlarTop, NoseLeftAlarOutTip, UpperLipTop, UpperLipBottom, MouthLeft, NoseRootRight, NoseRightAlarTop, NoseRightAlarOutTip, MouthRight, UnderLipTop, UnderLipBottom

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Face Service

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Face Attributes

- **Accessories.** (Wearing accessories)
- **Age**
- **Blur** (blurriness of the face in the image)
- **Emotion.**
- **Exposure**
- **Facial hair**
- **Gender**
- **Glasses**
- **Hair**
- **Head pose**
- **Makeup**
- **Mask.** (are they wearing a mask?)
- **Noise.** The visual noise detected in the face image
- **Occlusion.** (objects blocking parts of the face)
- **Smile**

Person aged approximately 44
 Gender: male
 Makeup: ('eye_makeup': False, 'lip_makeup': False)
 - anger: 0.0
 - contempt: 0.0
 - disgust: 0.0
 - fear: 0.0
 - happiness: 0.998
 - neutral: 0.002
 - sadness: 0.002
 - surprise: 0.0

Speech & Translate Service:

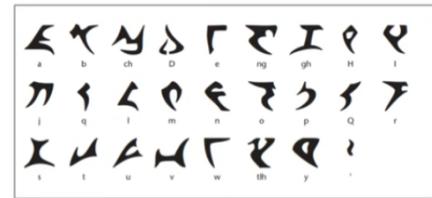
Speech and Translate Service

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Azure's Translate service is a **translation service**.

- It can translate 90 languages and dialects
 - It even supports **Klingon!** 
- It uses **Neural Machine Translation (NMT)** replacing its legacy **Statistical Machine Translation (SMT)**
- **Custom Translator** allows you to extend the service for translation based on your business and domain use case



Azure Speech service can **speech synthesis service** speech-to-text, text-to-speech, and speech-translation

Speech-to-Text

- Real-time Speech-to-text
- Batch Speech-to-Text
- Multi-device Conversation
- Conversation Transcription
- Create Custom Speech Models

Text-to-Speech

- using Speech Synthesis Markup Language (SSML)
- Create Custom Voices

Voice Assistance

- integrates with Bot Framework SDK

Speech Recognition

- Speaker verification & identification



Text Analytics:



Text Analytics

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Text Analytics API is a **Natural Language Processing (NLP)** service for **text mining and text analysis**

Text Analytics can perform:

- **sentiment analysis**
 - find out what people think of your brand or topic
 - feature provides sentiment labels (such as "negative", "neutral" and "positive")
- **opinion mining**
 - aspect-based sentiment analysis
 - granular information about the opinions related to aspects
- **key phrase extraction**
 - quickly identify the main concepts in text.
- **language detection**
 - detect the language an input text is written in
- **named entity recognition (NER)**
 - Identify and categorize entities in your text as people, places, organizations, quantities
 - Subset of NER is Personally Identifiable Information (PII)



The PII detection feature can identify, categorize, and redact sensitive information in unstructured text.aa

Nlp-key phrase extraction:

NLP – Key Phrase Extraction

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Key Phrase Extraction quickly identify the main concepts in text

- Key phrase extraction works best when you give it bigger amounts of text to work on
- This is opposite from sentiment analysis, which performs better on smaller amounts of text
- Document size must be 5,120 or fewer characters per document, and you can have up to 1,000 items (IDs) per collection

When the Borg launch an attack on Earth, the Enterprise is sent to the neutral zone due to the Admiralty's mistrust of Picard's abilities as he had been assimilated in the past. The Enterprise however, disobeys and returns to help destroy the Borg ship. However a smaller ship escapes and travels back in time, causing the assimilation of Earth in the future. The Enterprise follows the ship back in time and have to undo the damage the ship did on the surface to an experimental warp drive unit that will lead Earth to its first contact with alien life. Meanwhile, on the Enterprise, survivors of the Borg ship begin to assimilate decks within the ship itself....

Key Phrases:
Borg ship
Enterprise
smaller ship escapes
time
assimilation of Earth
surface
experimental warp drive unit
Admiralty's mistrust of Picard's abilities
neutral zone
travels
contact
damage
attack
survivors
decks
alien life
future
past



Named Entity Recognition:

Named Entity Recognition

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Named Entity Recognition detects **words and phrases mentioned in unstructured text** that can be **associated with one or more semantic types**.

Ribavirin [UMLS: C0035525] was also evaluated against SARS-CoV-2 infection , but the antiviral [UMLS: C0003451] .
MEDICATION_NAME DIAGNOSIS MEDICATION_CLASS

property of drugs [UMLS: C0013227] is still not well established against the SARS-CoV-2 [UMLS: C5203670] negation .
TREATMENT_NAME DIAGNOSIS

In addition, after oral administration, the drug was rapidly absorbed into the GI tract [UMLS: C0017189] .
ROUTE_OR_MODE BODY_STRUCTURE

The drug has oral bioavailability around 64 % with large volume of distribution.
ROUTE_OR_MODE EXAMINATION_VALUE EXAMINATION_UNIT

Semantic types could be: Location, Event, Location, Person, Diagnosis, Age



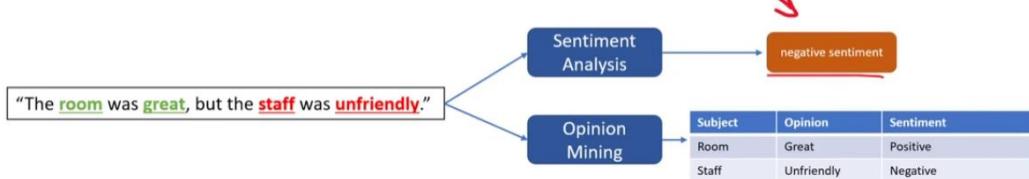
NLP-Sentiment Analysis

NLP – Sentiment Analysis

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Sentiment analysis will apply labels and confidence score to text at the **sentence and document level**.

- Labels include **negative, positive, mixed or neutral**
- Confidence scores ranging from 0 to 1



Opinion mining will provide more granular data with a **Subject** and **Opinion** tied to a Sentient



OCR:



Optical Character Recognition (OCR)

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Optical character recognition (OCR) is the process of **extracting printed or handwritten text** into a digital and editable format

OCR can be applied to:

- photos of street signs
- **Products** 
- Documents
- Invoices
- Bills
- Financial Reports
- Articles
- and more



Optical Character Recognition (OCR)

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Azure has **two different APIs** that can perform OCR: **OCR API** and **Read API**

OCR API

- older recognition model
- supports only images
- executes synchronously
 - returning immediately with the detected text
 - Suited for less text
- Support more languages
- Easier to implement

Read API

- updated recognition model
- Supports images and PDFs
- Executes asynchronously
 - parallelizes tasks per line for faster results
 - Suited for lots of text
- Supports fewer languages
- A bit more difficult to implement



OCR is performed via the **Computer Vision SDK**



Form Recognizer:



Form Recognizer Service

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Azure Form Recognizer is a **specialize OCR service** (translates printed text into digital and editable content) and **preserves that structure and relationship of form-like data**

Form Recognizer to **automate data entry** in your applications and **enrich your documents search capabilities**

Form Recognizer can identify:

- Key Value Pairs
- Selection Marks
- Table Structures

Form Recognizer outputs structures such as:

- Original file relationships
- Bounding boxes
- Confidence scores

Form Recognizer is composed of

- Custom document processing models
- Prebuilt models for invoices, receipts, IDs, business cards
- The Layout Model



General layout :



Form Recognizer Service – Layout

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Extract text, selection marks, and tables structures, along with their bounding box coordinates, from documents

Form Recognizer can extract text, selection marks, and table structure (the row and column numbers associated with the text) using high-definition optical character recognition (OCR) and an enhanced deep learning model from documents

Adventure Works Cycles Natural Health Sports and Business division Customer Service Tel: +44 1234 567890 Fax: +44 123 456789					
00077710				15/09/20	
Invoice nr:				19445003	
N F 845 089 98				AV DOLCE	
				In	15/12/18
				Out	17/12/18
				Rate	
CUSTOMER 029 VALEO					
Reduction	Unit	Quantity	SEI	3 NB	E/S - 1
TAX 1 SPS	TJ	18358		1	Unit Price
Shop monitoring	TJ	18358		10000,00	10000,00
Fees	TJ	18358		0,119	10150,00
Stay tax	TJ	18358		0,135	1414,00
Lighthouse	TJ	18358		0,033	30706,00
					25621,00
					30706,00
					25621,00
N-UM 644889,00					
TOTAL 103184,00					
N-AM 748072,00					
VAT					
TOTAL VAT Incl					
Invoice amount is the following: Seven hundred forty eight thousand seventy two CFA					
Responsible			Service head		Director



Custom Model:



Form Recognizer Service – Custom Models

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Custom models allows you to **extract text, key/value pairs, selection marks, and table data** from forms

- These models are trained with your own data, so they're tailored to your forms
- you only need five sample input forms to start.
- A trained document processing model can output structured data that includes the relationships in the original form document.
- After you train the model, you can test and retrain it and eventually use it to reliably extract data from more forms according to your needs.

You have **2 learning options:**

Train without Labels

uses **unsupervised learning** to understand the layout and relationships between fields and entries in your forms

Train with Labels

uses **supervised learning** to extract values of interest, using the labeled forms you provide (trained data).



PreBuilt model:

Receipts, invoice, business cards, ID

LUIS : Language Understanding Service



Language Understanding Service (LUIS)

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Language Understanding (LUIS) is a no-code ML service to build natural language into apps, bots, and IoT devices.

Quickly create enterprise-ready, custom models that continuously improve.

LUIS is accessed via its own isolate domain at luis.ai

LUIS utilizes Natural Language Processing (NLP) and **Natural Language Understanding (NLU)**

NLU is the ability to *transform* a linguistic statement to a representation that enables you to understand your users naturally

LUIS is intended to focus on **intention** and **extraction**:

- What the user wants
- What they are talking about





Language Understanding Service (LUIS)

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A LUIS application is composed of a **schema** →
This schema is autogenerated for you when you
use the LUIS.ai web interface

The schema defines:

- **intentions** — what the user is asking for
 - a LUIS app always contains a **None** Intent
- **entities** — what parts of the intent is used to determine the answer
- **utterances** — Examples of user input that includes intent and entities to train the ML model to match predictions against real user input
 - An intent requires one or more example utterance for training
 - It is recommended to have 15-30 example utterances
 - To explicitly train to ignore an utterance use the None Intent

Intents **classify** user utterances
Entities **extract** data from utterance

Example Utterance

book me **two flights to Toronto**

↑ Entities

→ bookFlight

Intent

```
{  
  "luis_schema_version": "7.0.0",  
  "intents": [  
    {  
      "name": "None",  
      "features": []  
    }  
  ],  
  "entities": [],  
  "hierarchicals": [],  
  "composites": [],  
  "closedLists": [],  
  "prebuiltEntities": [],  
  "utterances": [],  
  "versionId": "0.1",  
  "name": "example-app",  
  "desc": "",  
  "culture": "en-us",  
  "tokenizerVersion": "1.0.0",  
  "patternAnyEntities": [],  
  "regex_entities": [],  
  "phraselists": [  
  ],  
  "regex_features": [],  
  "patterns": [],  
  "settings": []  
}
```

(A)
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QnA Maker Service:



QnA Maker Service

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QnA Maker is a **cloud-based Natural Language Processing (NLP) service** that
allows you **to create a natural conversational layer** over your data.

QnAMaker is hosted on its own isolate
domain at www.qnamaker.ai

It will find the most appropriate answer for any input from
your **custom knowledge base (KB)** of information

Commonly used to build conversational
client applications, which include:

- social media applications
- chat bots
- speech-enabled desktop applications

QnA Maker doesn't store customer data

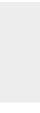
All customer data is stored in the region the customer
deploys the dependent service instances in

(A)
SUBSCRIBE



QnA Maker Service – Use Cases

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When you have static information

Use QnA Maker when you have static information in your knowledge base of answers. This knowledge base is custom to your needs, which you've built with documents such as PDFs and URLs.

When you want to provide the same answer to a request, question, or command

when different users submit the same question, the same answer is returned.

When you want to filter static information based on meta-information

add metadata tags to provide additional filtering options relevant to your client application's users and the information. Common metadata information includes chit-chat, content type or format, content purpose, and content freshness.

When you want to manage a bot conversation that includes static information

your knowledge base takes a user's conversational text or command and answers it. If the answer is part of a pre-determined conversation flow, represented in your knowledge base with multi-turn context, the bot can easily provide this flow.



QnA Maker Service – Knowledgebase

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QnA Maker imports your content into a knowledge base of question and answer pairs.

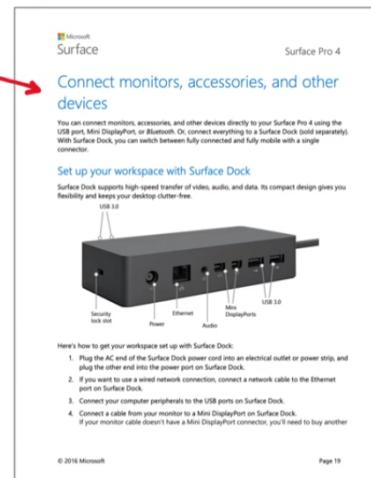
QnA Maker can build your knowledge base from an **existing document, manual or website (URL, DOCX, PDF)**

It will use ML to extract the question and answer pairs.

The content of the question and answer pair includes:

- All the alternate forms of the question
- Metadata tags used to filter answer choices during the search
- Follow-up prompts to continue the search refinement

QnA Maker stores answer text as **markdown**



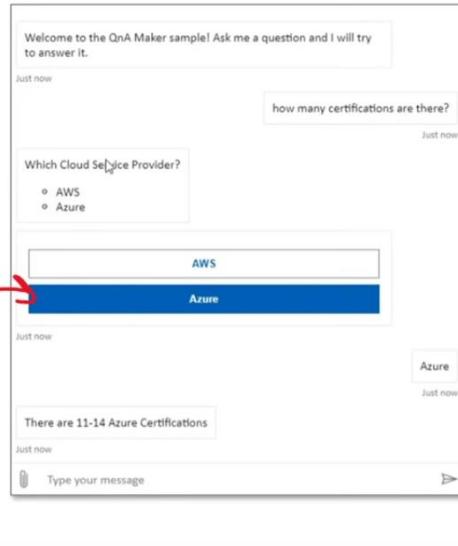
QnA Maker Service – Chat box

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You converse with your bot through a Chat Box. There are many opportunities to interact with your bot in QNAMaker.ai, Azure Bot Service, Bot Composer.

Via Channels you can even get embeddable chatbox code

Multi-turn conversation



If the user is asking random questions like how's life -→ to answer these questions use Chit Chat

QnA Maker Service – Chit Chat

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Chit-chat

- None
- Professional
- Friendly
- Witty
- Caring
- Enthusiastic

The chit-chat feature in QnA maker allows you to easily add a **pre-populated set of the top chit-chat**, into your knowledge base.

This dataset has about **100 scenarios** of chit-chat in the voice of multiple personas



QnA Maker Service – Layered Ranking

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QnA Maker's system is a layered ranking approach.

The data is stored in Azure search, which also serves as the first ranking layer.

The top results from Azure search are then passed through QnA Maker's NLP re-ranking model to produce the final results and confidence score.

QnA Maker Service – Multi-turn conversation

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Multi-turn conversation is **follow-up prompts** and context to manage the multiple turns, known as *multi-turn*, for your bot from one question to another

When a question **can't be answered in a single turn**

QnA Maker provides multi-turn prompts and active learning to help you improve your basic question and answer pairs.

Multi-turn prompts give you the opportunity to connect question and answer pairs. This connection allows the client application to provide a top answer and provides more questions to refine the search for a final answer.

After the knowledge base receives questions from users at the published endpoint, QnA Maker applies **active learning** to these real-world questions to suggest changes to your knowledge base to improve the quality.



Azure Bot Service:



Azure Bot Service

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Azure Bot Service Intelligent, serverless bot service that scales on demand.
Used for **creating, publishing, and managing bots**

You can **register and publish** a variety of bots from the Azure Portal

Azure Bot Service can integrate your bot with other Azure, Microsoft or Third Party services via **Channels**:

- Direct Line
- Alexa
- Office 365 email
- Facebook
- Kik
- LINE
- Microsoft Teams
- Skype
- Twilio
- ande more....

	Speech to text Cerebral Technologies Private Limited
	Think AI Bot for Connectwise Think AI Consulting Corporation
	Vernacular.ai Intelligent Voice Assistant Vernacular.ai
	devNXT- AI driven smart application development Wipro Ltd
	Rx.Health Rx.Health
	Zammo AI SaaS Zammo, Inc.
	Audite Cloud TALENTIUM
	Mia - Workplace Virtual Assistant MHCN
	Azure Health Bot Microsoft

	Web App Bot Microsoft
	Bot Channels Registration Microsoft
	Azure Bot Microsoft

Bot Framework SDK

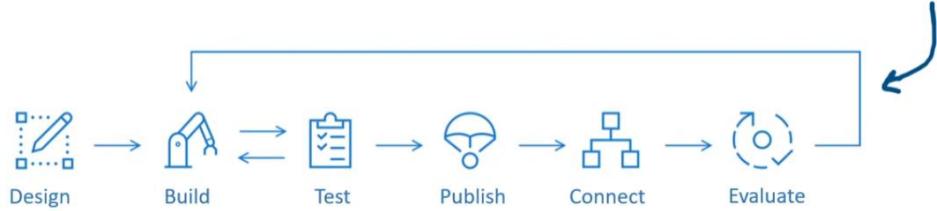


Bot Framework SDK

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The Bot Framework SDK v4 is an **open-source SDK** that enable developers to **model and build sophisticated conversations**

The Bot Framework, along with the Azure Bot Service, provides and **end-to-end workflow**:



With this framework, developers can create bots that use speech, understand natural language, handle questions and answers, and more.

The Bot Framework includes a modular and extensible SDK for building bots, as well as tools, templates, and related AI services.

Bot Framework Composer



Bot Framework Composer

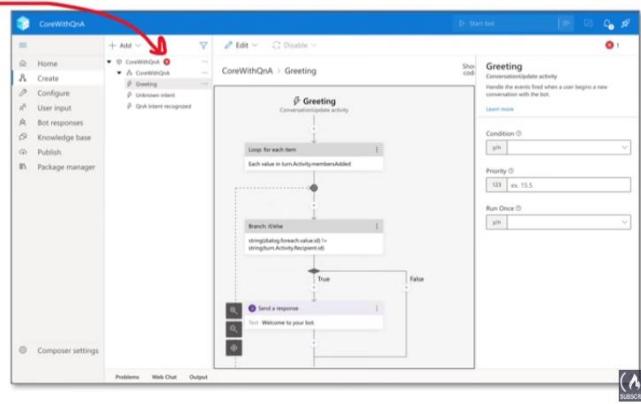
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Bot Framework Composer, built on the Bot Framework SDK, is an **open-source IDE for developers** to **author, test, provision and manage** conversational experiences.

Composer is downable app available for Windows, OSX and Linux

- You can use either C# or Node to build your bot
- Deploy your bots to:
 - Azure Web App
 - Azure Functions
- Templates to build:
 - QnA Maker Bot
 - Enterprise or Personal Assistant Bot
 - Language Bot
 - Calendar or People Bot
- Test and debug via the Bot Framework Emulator
- Built in Package manager



Azure Machine Learning Service



Azure Machine Learning Service

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Azure Machine Learning Studio (classic)

An older service that manages AI/ML workloads. Does not have a pipeline and other limitations. Workloads are not easily transferable to from classic to the new service.



Azure Machine Learning Service

A service that simplifies running AI/ML related workloads allowing you to build flexible Automated ML Pipelines. Use Python or R, Run DL workloads such as Tensorflow

Jupyter Notebooks

- build and document your machine learning models as you build them, share and collaborate

Azure Machine Learning SDK for Python

- An SDK designed specifically to interact with Azure Machine Learning Services

MLOps

- end to end automation of ML model pipelines eg. CI/CD, training, inference

Azure Machine Learning Designer

- drag and drop interface to visually build, test, and deploy machine learning models

Data Labeling Service

- ensemble a team of humans to label your training data

Responsible Machine Learning

- model fairness through disparity metrics and mitigate unfairness



Machine Learning Studio :

Azure Machine Learning Studio – Overview

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Author

- Notebooks
- Automated ML
- Designer

Assets

- Datasets
- Experiments
- Pipelines
- Models
- Endpoints

Manage

- Compute
- Environments (preview)
- Datastores
- Data Labeling
- Linked Services

Compute — the underlying computing instances used to run notebooks, training, inference
Environments — a reproducible Python environment for machine learning experiments
Datastores — a data repository where your dataset resides
Data Labeling — have humans with ML-assisted labeling to label your data for supervised learning
Linked Services — external services you can connect to the workspace eg. Azure Synapse Analytics

Compute

Azure Machine Learning Studio – Compute

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Azure Machine Learning Studio has **4 kinds of compute:**

Name	State	Applications
myjuptcompute	Running	JupyterLab Jupyter VS Code RStudio Terminal

1. **Compute Instances** — Development workstations that data scientists can use to work with data and models.
2. **Compute Clusters** — Scalable clusters of virtual machines for on-demand processing of experiment code.
3. **Inference Clusters** — Deployment targets for predictive services that use your trained models.
4. **Attached Compute** — Links to existing Azure compute resources, such as Virtual Machines or Azure Databricks clusters.

Data labelling

Azure Machine Learning Studio – Data Labeling

Cheat sheets, Practice Exams and Flash cards  www.exampro.co/ai-900

Create Data labeling jobs to prepare your Ground Truth for supervised learning

Human-in-the-loop labeling

You have a team of humans that will apply labeling
These are humans you grant access to labeling

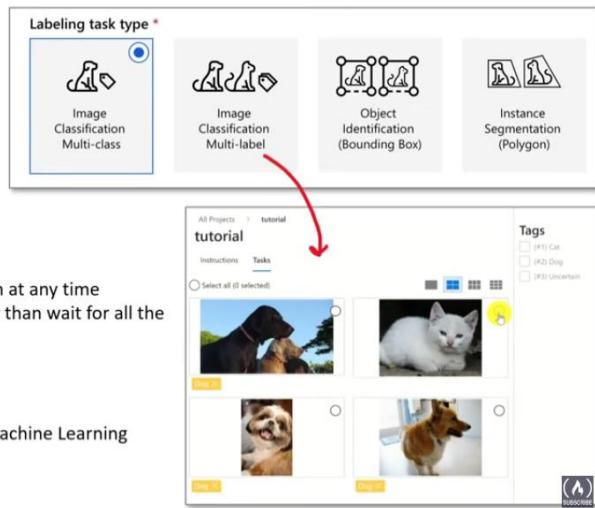
Machine-learning-assisted data labeling

You will use ML to perform labeling

You can export the label data for Machine Learning experimentation at any time
Users often export multiple times and train different models, rather than wait for all the images to be labeled.

Image labels can be exported in:

- COCO format
- Azure Machine Learning dataset
 - dataset format makes it easy to use for training in Azure Machine Learning



Data Stores

Azure Machine Learning Studio – Data Stores

Cheat sheets, Practice Exams and Flash cards  www.exampro.co/ai-900

Datastores securely connect to your storage service on Azure without putting your authentication credentials and the integrity of your original data source **at risk**.

Datastore type *
Azure Blob Storage
Azure Blob Storage
Azure file share
Azure Data Lake Storage Gen1
Azure Data Lake Storage Gen2
Azure SQL database
Azure PostgreSQL database
Azure MySQL database

Azure Blob Storage

data is stored as objects, distributed across many machines

Azure File Share

a mountable file share via SMB and NFS protocols

Azure Data Lake Storage (Gen 2)

Azure Blob storage designed for vasts amount of data for Big Data analytics

Azure SQL database

Full-managed MS SQL relational database

Azure Postgres database

open-source relational database

Azure MySQL Database

Open-source relational database



Experiments

Azure Machine Learning Studio – Experiments

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Experiments is a logical grouping Azure Runs

Runs are the act of running an ML task on a virtual machine or container

Experiment	Latest run	Last submitted ↓	Created	Created by	Run types
dataset_profile	1	Jun 5, 2021 10:30 AM	Jun 5, 2021 10:30 AM	Andrew Brown	Script
MyDiabetes	2	Jun 4, 2021 4:39 PM	Jun 4, 2021 4:36 PM	Andrew Brown	Automated ML
MyExperiment	1	Jun 4, 2021 4:19 PM	Jun 4, 2021 4:19 PM	Andrew Brown	Pipeline

The contents of a run will vary based on its Run Type

Experiments don't include inference.

Pipelines

Azure Machine Learning Studio – Pipelines

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Azure ML Pipelines is an executable workflow of a complete machine learning task

Subtasks are encapsulated as a series of steps within the pipeline

Independent steps allow multiple data scientists to work on the same pipeline at the same time without over-taxing compute resources

Separate steps also make it easy to use different compute types/sizes for each step.

When you rerun a pipeline, the run jumps to the steps that need to be rerun, such as an updated training script.

Steps that do not need to be rerun are skipped

After a pipeline has been published, you can configure a REST endpoint, which allows you to rerun the pipeline from any platform or stack

You can build pipelines two ways:

- Using the Azure Machine Learning Designer
- Programmatically using the Azure Machine Learning Python SDK**

```

ws = Workspace.from_config()
blob_store = Datastore(ws, "workspaceblobstore")
compute_target = ws.compute_targets["STANDARD_NC6"]
experiment = Experiment(ws, 'MyExperiment')

input_data = Dataset.File.from_files(
    DataPath(blob_store, '20newsgroups/20news.pkl'))
prepped_data_path = OutputFileDatasetConfig(name="output_path")

dataprep_step = PythonScriptStep(
    name="prep_data",
    script_name="dataprep.py",
    source_directory="prep_src",
    compute_target=compute_target,
    arguments=[ "--prepped_data_path", prepped_data_path ],
    inputs=[input_dataset.as_named_input('raw_data').as_mount() ]
)

prepped_data = prepped_data_path.read_delimited_files()

train_step = PythonScriptStep(
    name="train",
    script_name="train.py",
    compute_target=compute_target,
    arguments=[ "--prepped_data", prepped_data ],
    source_directory="train_src"
)
steps = [ dataprep_step, train_step ]

pipeline = Pipeline(workspace=ws, steps=steps)

pipeline_run = experiment.submit(pipeline)
pipeline_run.wait_for_completion()

```

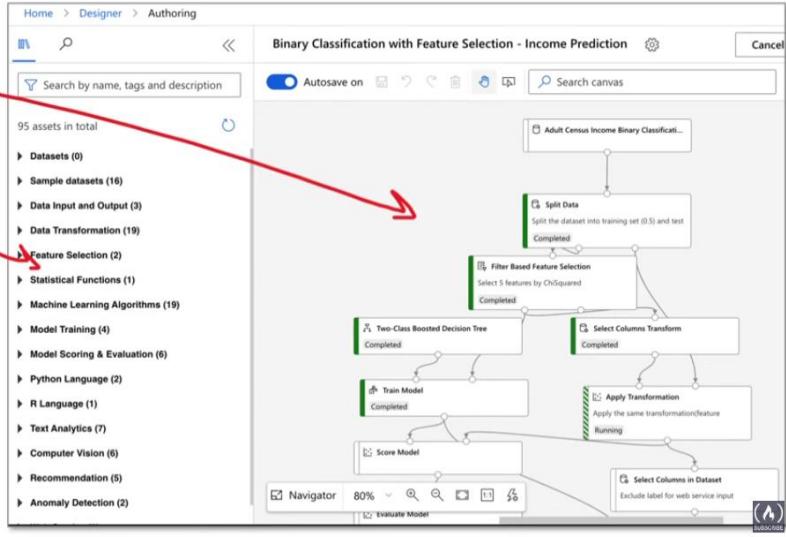
ML-Designer

Azure Machine Learning Studio – ML Designer

Cheat sheets, Practice Exams and Flash cards www.exampro.co/ai-900

The Azure Machine Learning Designer lets you **quickly build Azure ML Pipelines without having to write code.**

You can **drag out various templated steps** called assets to quickly prototype your pipeline

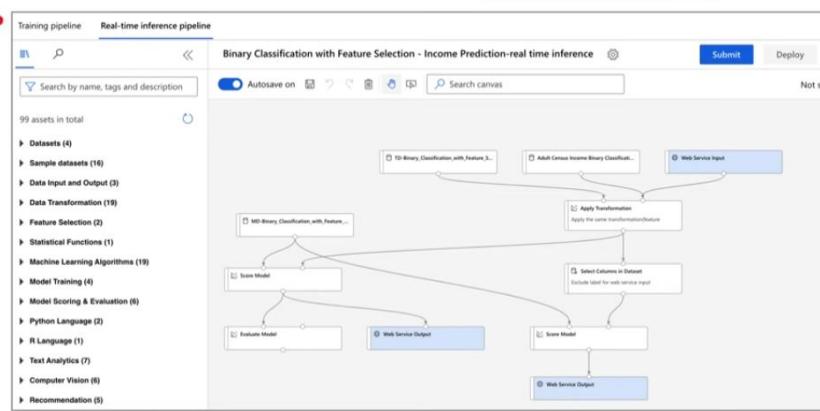
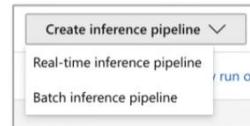


Azure Machine Learning Studio – Machine Learning Designer

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One a pipeline is trained you can create an **inference pipeline**

You can **toggle** between your training in inference pipeline



Model Registry

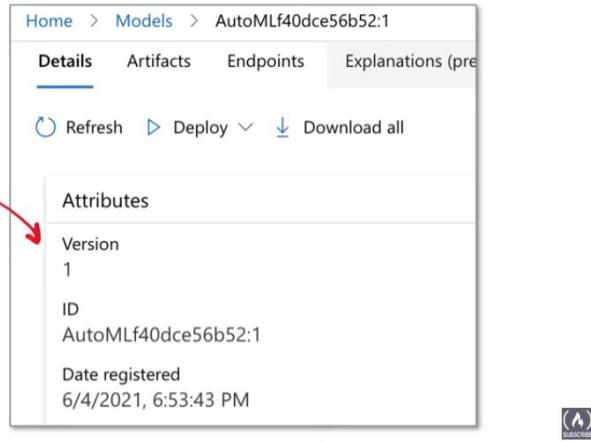
Azure Machine Learning Studio – Models

Cheat sheets, Practice Exams and Flash cards  www.exampro.co/ai-900

Model Registry allows you to **create, manage and track your registered models** as incremental versions under the same name

Each time you register a model with the same name as an existing one, the registry assures that **it's a new version.**

Additionally, you can provide metadata tags and use the tags when you search for models.



The screenshot shows the Azure Machine Learning Studio interface for managing models. The URL in the address bar is `Home > Models > AutoMLf40dce56b52:1`. The top navigation bar includes **Details**, **Artifacts**, **Endpoints**, and **Explanations (pre)**. Below the navigation are buttons for **Refresh**, **Deploy**, and **Download all**. The main content area is titled **Attributes** and displays the following information:

Version	1
ID	AutoMLf40dce56b52:1
Date registered	6/4/2021, 6:53:43 PM

At the bottom right of the content area is a small **(A) SUBSCRIBE** button.

Endpoints

Azure Machine Learning Studio – Endpoints

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Azure ML Endpoints allow you to **deploy machine learning models as a web service**

The workflow for deploying a model:

- Register the model
- Prepare an entry script
- Prepare an inference configuration
- Deploy the model locally to ensure everything works
- Choose a compute target
- Re-deploy the model to the cloud
- Test the resulting web service

Realtime endpoints

An endpoint that provides remote access to invoke the ML model service running on either:

- Azure Kubernetes Service (AKS)
- Azure Container Instance (ACI)

Pipeline endpoints

An endpoint that provide remote access to invoke an ML pipeline.

You can parametrize the pipeline endpoint for managed repeatability in batch scoring and retraining scenarios.



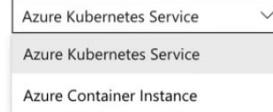
Azure Machine Learning Studio – Endpoints

Cheat sheets, Practice Exams and Flash cards www.exampro.co/ai-900

Compute type *

When you **deploy a model** to an endpoint it will either be deployed to:

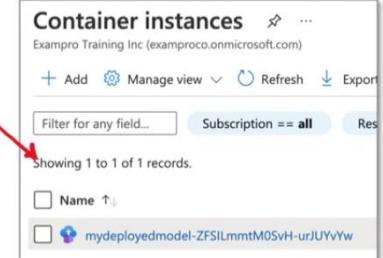
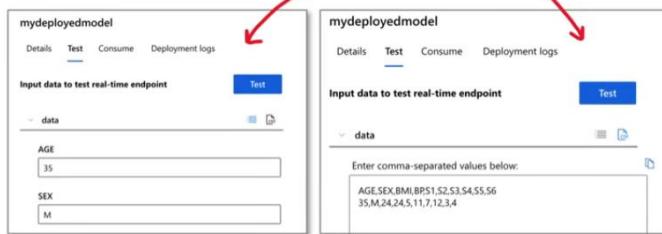
- Azure Kubernetes Service (AKS)
- Azure Container Instance (ACI)



The computing resource will not show in Azure Machine Learning Studio

You need to check AKS or ACI

When you have deployed a real-time endpoint you can test the endpoint by sending a **single request** or a **batch request**.



Container instances

Showing 1 to 1 of 1 records.

Name
mydeployedmodel-ZFSILmmmtM0SvH-urJUYyYw



Notebooks

Azure Machine Learning Studio – Notebooks

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Azure has a built in **Jupyter-like Notebook editor** so you can build and train your ML models

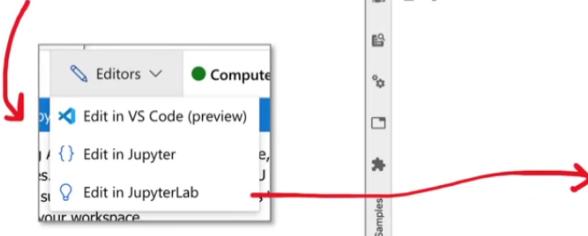
The screenshot shows the Azure Machine Learning Studio interface for Notebooks. On the left, there's a sidebar with 'Notebooks' and a file tree showing 'img-classification-part1-train.ipynb'. The main area is a Jupyter-like notebook editor with code cells. A red arrow points to the 'Compute' dropdown menu at the top right, which is set to 'MyProfilerCompute - Running'. Another red arrow points to the 'Kernel' dropdown menu, which is set to 'Python 3.6 - AzureML'. To the right of the editor, there are two sections: 'Choose Compute' (with text about creating a compute instance) and 'Choose Kernel' (with text about choosing a programming language and libraries).

Azure Machine Learning Studio – Notebooks

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You can open the Notebook in a more familiar IDE:

- VSCode
- Jupyter Notebook (classic)
- **Jupyter Labs**



The screenshot shows the Azure Machine Learning Studio Notebooks interface with the VS Code preview open. It displays a file browser on the left showing 'img-classification-part1-trn.ipynb' and 'img-classification-part1-trz.ipynb'. The main area shows Python code for importing packages and connecting to a workspace. A red arrow points from the 'Edit in' dropdown in the previous screenshot to this interface.

AutoML

AutoML

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Automated machine learning (AutoML) **automates the process of creating an ML model.**

With Azure AutoML you

- supply a dataset
- **Choose a Task Type** (Classification, Regression or Time Series Forecasting)
- Then AutoML will train and tune your model

Classification

When you need to make a prediction based on several classes:

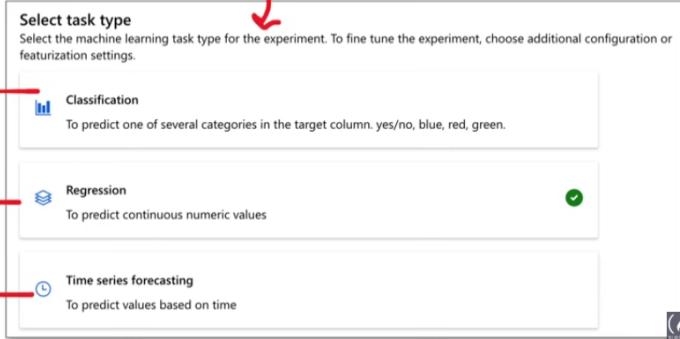
- binary classification: Yes or No
- multi-class classification: Red, Green, Blue

Regression

When you need to predict a continuous number value

Time Series Forecasting

When you need to predict the value based on time



AutoML – Classification

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Classification is a type of **supervised learning** in which **models learn using training data**, and apply those learnings to new data.

Classification

To predict one of several categories in the target column. yes/no, blue, red, green.

Enable deep learning 

If you enable Deep Learning than you will likely want a **GPU compute**

The goal of classification models is to **predict which categories new data will fall into** based on learnings from its training data:

- **binary classification:** a record is labeled out of two possible labels eg: true or false
- **multiclass classification:** a record is labeled out of range of labels: happy, sad, mad, rad

AutoML – Time Series Forecasting

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Forecast revenue, inventory, sales, or customer demand

An automated time-series experiment is treated as a **multivariate regression problem**

Past time-series values are "pivoted" to become additional dimensions for the regressor together with other predictor

unlike classical time series methods, has an advantage of naturally incorporating multiple contextual variables and their relationship to one another during training

 **Time series forecasting**
To predict values based on time

The time series forecasting method requires some additional information.

Time column * 

Time series identifier(s) * 

Frequency * 

Autodetect

Forecast horizon * 

Autodetect

Enable deep learning 



AutoML – Time Series Forecasting

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Advanced forecasting configuration includes:

- holiday detection and featurization
- time-series and DNN learners (Auto-ARIMA, Prophet, ForecastTCN)
- many models support through grouping
- rolling-origin cross validation
- configurable lags
- rolling window aggregate features



Data Guard Rails

AutoML – Data Guard Rails

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Data guardrails are run by Azure AutoML when **automatic featurization** is enabled.
A sequence of checks to **ensure high quality input data** is being used to train model.



Type	Status	Description	Checkmark
Validation split handling	Done	The input data has been split for validation to improve model performance. Learn more about validation data.	✓
+ View additional details			
Missing feature values imputation	Passed	No feature missing values were detected in the training data. Learn more about missing value imputation.	✓
+ View additional details			
High cardinality feature detection	Passed	Your inputs were analyzed, and no high cardinality features were detected. Learn more about high cardinality feature detection.	✓
+ View additional details			

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Automatic Featurization

AutoML – Automatic Featurization

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During model training with AutoML, one of the following **scaling or normalization techniques** will be applied to each model



StandardScaleWrapper — Standardize features by removing the mean and scaling to unit variance

MinMaxScalar — Transforms features by scaling each feature by that column's minimum and maximum

MaxAbsScaler — Scale each feature by its maximum absolute value

RobustScalar — Scales features by their quantile range

Principal component analysis (PCA) — Linear dimensionality reduction using Singular Value Decomposition of the data to project it to a lower dimensional space

TruncatedSVDWrapper — This transformer performs linear dimensionality reduction by means of truncated singular value decomposition (SVD). Contrary to PCA, this estimator does not center the data before computing the singular value decomposition, which means it can work with `scipy.sparse` matrices efficiently

SparseNormalizer — Each sample (that is, each row of the data matrix) with at least one non-zero component is rescaled independently of other samples so that its norm ($\|1$ or $\|2$) equals one

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Model Selection

AutoML – Model Selection

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Model selection is the task of selecting a statistical model from a set of **candidate models**
Azure AutoML will use **many different ML Algorithms** and will recommend the best **performing candidate**

The top candidate

Explains the model

The results of running for different ML algorithms

Algorithm name	Explained	Normalized root mean squared error ↑	Sampling	Created	Duration
VotingEnsemble	View explanation	0.16695	100.00 %	Jun 4, ...	1m 33s
StackEnsemble		0.16931	100.00 %	Jun 4, ...	1m 37s
RobustScaler, LassoLars		0.17039	100.00 %	Jun 4, ...	1m 1s
StandardScalerWrapper, L...		0.17039	100.00 %	Jun 4, ...	1m 2s
RobustScaler, LassoLars		0.17039	100.00 %	Jun 4, ...	58s
RobustScaler, LassoLars		0.17039	100.00 %	Jun 4, ...	58s

Explanation - MLX

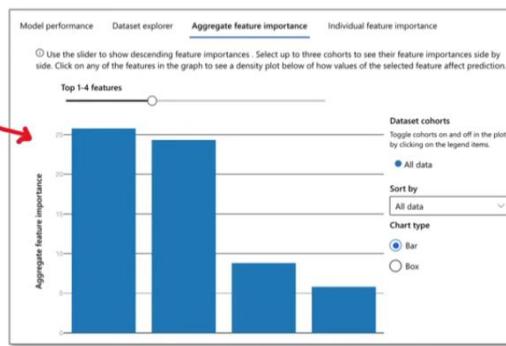
AutoML – Explanation

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ML Explainability (MLX) is the process of **explaining and interpreting** ML and deep learning models.
MLX can help machine learning developers to better understand and interpret the model's behavior

After your top candidate model is selected by Azure AutoML
you can get an explanation of the internals on various factors:

- Model Performance
- Dataset explorer
- **Aggregate feature importance**
- Individual feature importance



Primary Metrics

AutoML – Primary Metrics

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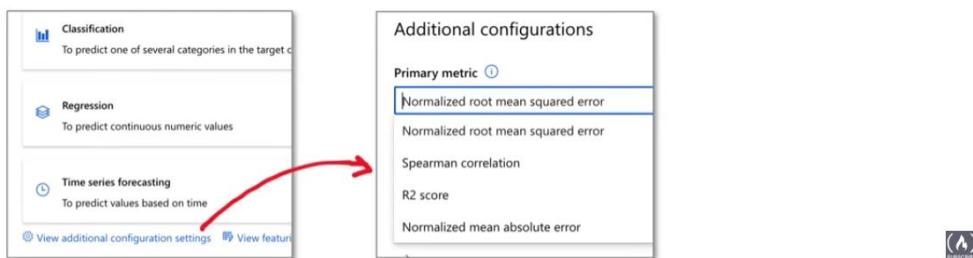
The primary metric parameter determines the metric to be used during model training for optimization.

Classification

- accuracy
- AUC_weighted
- average_precision_score_weighted
- norm_macro_recall
- precision_score_weighted

Regression and Time Series Forecasting

- spearman_correlation
- normalized_root_mean_squared_error
- r2_score
- normalized_mean_absolute_error



AutoML – Primary Metrics – Classification

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Classification Scenarios

- Suited for larger datasets that are well-balanced
 - **accuracy** — Image classification, Sentiment analysis, Churn prediction
 - **average_precision_score_weighted** — Sentiment analysis
 - **norm_macro_recall** — Churn prediction
 - **precision_score_weighted**
- Suited for small datasets that are imbalanced
 - **AUC_weighted** — Fraud detection, Image classification, Anomaly detection/spam detection



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AutoML - Primary Metrics – Classification

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Regressions Scenarios

- Works well when value to predict encompasses a large range eg. 10K to 200K
 - **spearman_correlation**
 - **r2_score** — Airline delay, Salary estimation, Bug resolution time
- Works well when value to predict encompasses a smaller range eg. 10-20K
 - **normalized_root_mean_squared_error** — Price prediction (house/product/tip), Review score prediction
 - **normalized_mean_absolute_error**

AutoML – Primary Metrics – Time Series

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Time Series Scenarios

- Works well when value to predict encompasses a large range eg. 10K to 200K
 - **spearman_correlation**
 - **r2_score** — Price prediction (forecasting), Inventory optimization, Demand forecasting
- Works well when value to predict encompasses a smaller range eg. 10-20K
 - **normalized_root_mean_squared_error** — Price prediction (forecasting), Inventory optimization, Demand forecasting
 - **normalized_mean_absolute_error**

Validation Type

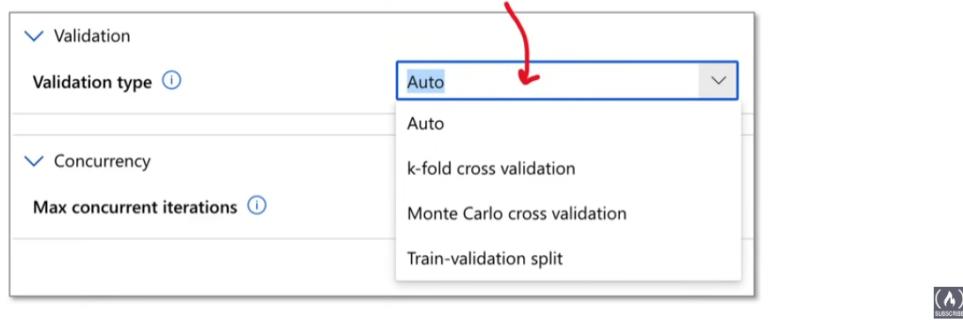
AutoML – Validation Type

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Model Validation is when we **compare the results of our training dataset to our test dataset.**

Model Validation occurs *after* we train the model

With AutoML you can change the validation type



Custom Vision



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Custom Vision is a **fully-managed no-code** service to quickly build your own **Classification and Object Detection ML models.**

This service is hosted on its own isolate domain at www.customvision.ai

Upload Images

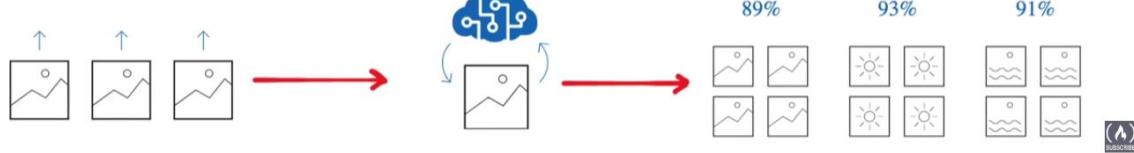
Bring your own labeled images, or use Custom Vision to quickly add tags to any unlabeled images.

Train

Use your labeled images to teach Custom Vision the concepts you care about.

Evaluate

Use simple REST API calls to quickly tag images with your new custom computer vision model.



Project Types –



Custom Vision – Project Types

Cheat sheets, Practice Exams and Flash cards www.exampro.co/ai-900

Within Custom Vision you setup projects and you need to select a **Project Type**

Project Types

- Classification
- Object Detection

Classification Types

- Multilabel (Multiple tags per image)
- Multiclass (Single tag per image)

Classification

- **Multi-label**

- When we want to apply many tags to an image
 - Image contains both a Cat and a Dog

- **Multi-class**

- when we only have one possible tag to apply to an image:
 - It is either a Apple, Banana, Orange

Object Detection

- When we to detect various objects in an image

You will need to also choose a **Domain**

A Domain is a Microsoft Managed dataset that is used for training the ML model



Classification Domain –



Custom Vision – Image Classification Domains

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Classification Domains

Project Types (1)

- Classification
- Object Detection

Classification Types (1)

- Multilabel (Multiple tags per image)
- Multiclass (Single tag per image)

Domains:

- General [A2]
- General [A1]
- General
- Food
- Landmarks
- Retail
- General (compact) [S1]
- General (compact)
- Food (compact)
- Landmarks (compact)
- Retail (compact)



General Optimized for a broad range of image classification tasks. If none of the other specific domains are appropriate, or if you're unsure of which domain to choose, select one of the General domains.

General [A1] Optimized for better accuracy with comparable inference time as General domain. Recommended for larger datasets or more difficult user scenarios. This domain requires more training time.

General [A2] Optimized for better accuracy with faster inference time than General[A1] and General domains. Recommended for most datasets. This domain requires less training time than General and General [A1] domains.

Food Optimized for photographs of dishes as you would see them on a restaurant menu. If you want to classify photographs of individual fruits or vegetables, use the Food domain.

Landmarks Optimized for recognizable landmarks, both natural and artificial. This domain works best when the landmark is clearly visible in the photograph. This domain works even if the landmark is slightly obstructed by people in front of it.

Retail Optimized for images that are found in a shopping catalog or shopping website. If you want high-precision classifying between dresses, pants, and shirts, use this domain.

Compact domains Optimized for the constraints of real-time classification on edge devices.



Custom Vision – Object Detection Domains

Cheat sheets, Practice Exams and Flash cards www.exampro.co/ai-900

Object Detection Domains

Project Types (1)

- Classification
- Object Detection

Domains:

- General [A1]
- General
- Logo
- Products on Shelves
- General (compact) [S1]
- General (compact)

General

Optimized for a broad range of object detection tasks. If none of the other domains are appropriate, or you are unsure of which domain to choose, select the General domain.

General [A1]

Optimized for better accuracy with comparable inference time as General domain. Recommended for more accurate region location needs, larger datasets, or more difficult user scenarios. This domain requires more training time, and results are not deterministic: expect a +/-1% mean Average Precision (mAP) difference with the same training data provided.

Logo

Optimized for finding brand logos in images.

Products on shelves

Optimized for detecting and classifying products on shelves.



Azure AI Fundamentals Certification (AI-900) - Full Course to PASS the Exam

Custom Vision - Training

Cheat sheets, Practice Exams and Flash cards www.exampro.co/ai-900

When you are ready to train your model you have two options:

- **Quick Training** – trains quickly but can be less accurate
- **Advanced Training** – increase the compute time to improve your results

Training Types

- Quick Training
- Advanced Training

Advanced Training

In most cases, the more time you select the better the model will be. You're charged based on the compute time used to train your model, so choose your budget based on your need.

Training budget: 1 hour

1 hour | 24 hours

Send me an email notification after training completes

Object Detection **Classification**

tea-party

Iterations

Probability Threshold: 50% (radio button selected)

Overlap Threshold: 30%

Iteration 1

Probability Threshold: 50% (radio button selected)

Training...

1:54:18 / 4:06:57 • Custom Vision Features >

With each iteration of training our ML model will improve the evaluation metrics (**precision** and **recall**). The **probability threshold value** determines when to stop training when our evaluation metrics meet our desired threshold.

Custom Vision – Training

Cheat sheets, Practice Exams and Flash cards www.exampro.co/ai-900

Once the **Classification** training job is complete we will get a report of the evaluation metrics **outcome**

Precision

- being exact and accurate
- select items that are relevant

Recall (Sensitivity or True Positive Rate)

- How many relevant items returned

Average Precision (AP)

Iteration 1

Finished training on 6/5/2021, 1:30:09 PM using General [A2] domain
Iteration id: 4aa2a48f-a98-445e-b418-91186858a0f1
Classification type: Multiclass (Single tag per image)

Tag	Precision	Recall	AP
worl	100.0%	100.0%	100.0%
data	100.0%	100.0%	100.0%
crusher	100.0%	100.0%	100.0%

Performance Per Tag

Tag	Precision	Recall	AP	Image count
worl	100.0%	100.0%	100.0%	9
data	100.0%	100.0%	100.0%	9
crusher	100.0%	100.0%	100.0%	9

Responsible AI

Responsible AI

Cheat sheets, Practice Exams and Flash cards  www.exampro.co/ai-900

Responsible AI focuses on **ethical, transparent and accountable** use of AI technologies

Microsoft puts into practice Responsible AI via its six **Microsoft AI principles**

1. **Fairness** — AI systems should treat all people fairly
2. **Reliability and Safety** — AI systems should perform reliably and safely
3. **Privacy and Security** — AI systems should be secure and respect privacy
4. **Inclusiveness** — AI systems should empower everyone and engage people
5. **Transparency** — AI systems should be understandable
6. **Accountability** — People should be accountable for AI systems



Fairness

Responsible AI – Fairness

Cheat sheets, Practice Exams and Flash cards  www.exampro.co/ai-900

AI systems should treat all people fairly

AI systems can reinforce existing societal stereotypical
Bias can be introduced during the development of a pipeline

AI systems that are used to
allocate or withhold:

- opportunities
- resources
- Information

In domains:

- Criminal Justice
- Employment and Hiring
- Finance and Credit

eg. an ML model designed to select final applicants for a hiring pipeline
without incorporating any bias based on gender, ethnicity or may result in an unfair advantage

Azure ML can tell you how each feature can influence a model's prediction for bias



Fairlearn is an open-source python project to help data
scientist to improve fairness in their AI systems



Reliability & Safety

Responsible AI – Reliability and safety

Cheat sheets, Practice Exams and Flash cards  www.exampro.co/ai-900

AI systems should perform reliably and safely

AI software must be **rigorous tested** to ensure they work as expected before release to the end user

If there are scenarios where AI is making mistakes its important to release a report **quantified risks and harms** to end-users so they are informed of the short-comings of an AI solution

AI where concern for reliability and safety for humans is critically important:

- Autonomous Vehicle
- AI health diagnosis, AI suggesting prescriptions
- **Autonomous Weapon Systems**



Privacy & Security

Responsible AI – Privacy and security

Cheat sheets, Practice Exams and Flash cards  www.exampro.co/ai-900

AI systems should be secure and respect privacy

AI can require vast amounts of data to train Deep Learning ML models.

The nature of the ML model may require **Personally identifiable information (PII)**

It is important that we ensure protection of user data that it is not leaked or disclosed

In some cases ML Models can be run locally on a user's device so their PII remains on their device avoiding that vulnerability

AI Security Principles to detect malicious actors:

- Data Origin and Lineage
- Data Use Internal vs External
- Data Corruption Considerations
- Anomaly detection



Inclusiveness

Responsible AI – Inclusiveness

Cheat sheets, Practice Exams and Flash cards  www.exampro.co/ai-900

AI systems should empower everyone and engage people

If we can design AI solutions for the **minority** of users
Then we can design AI solutions for the majority of users

Minority Groups

- physical ability
- gender
- sexual orientation
- ethnicity
- other factors



Transparency

Responsible AI – Transparency

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AI systems should be understandable

Interpretability / Intelligibility is when end-users can understand the behaviour of the UI

Transparency of AI systems can result in

- Mitigating unfairness
- Help developers debug their AI systems
- Gaining more trust from our users

Those build AI systems should be:

- open about the why they are using AI
- open about the limitations of their AI systems

Adopting an open-source AI framework can provide transparency (at least from a technical perspective) on the internal workings of an AI systems



Accountability

Responsible AI – Accountability

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People should be accountable for AI systems

The structure put in place to consistently enacting
AI principles and taking them into account

AI systems should work within:

- framework of governance
- organizational principles

ethical and legal standards
that are clearly defined

Principles guide Microsoft on how they **Develop, Sell and Advocate** when working
with third-parties and this can push towards regulations towards AI Principles

