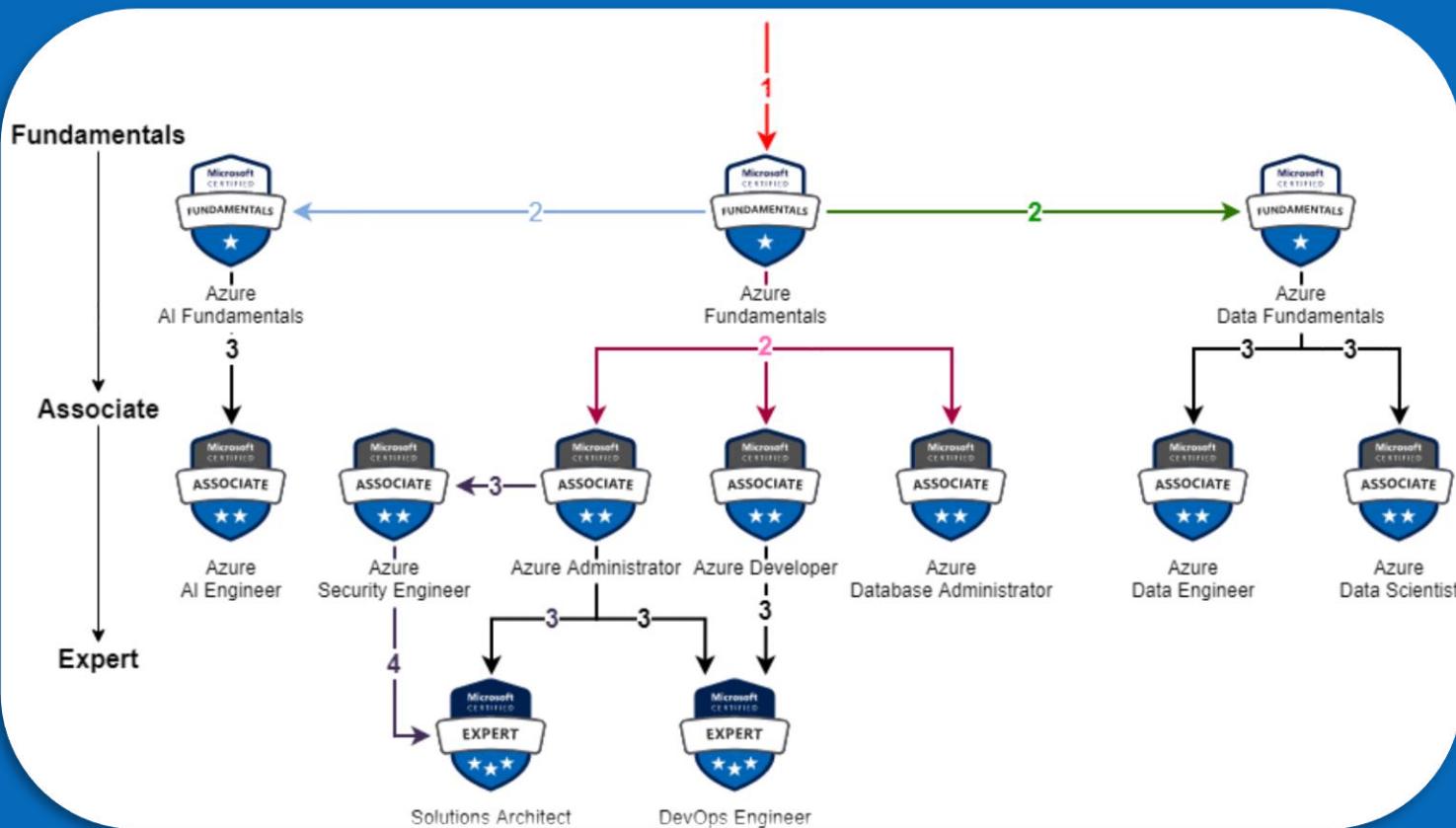


AI-900

Microsoft Azure AI Fundamentals



Azure Certificate Journey





Microsoft Certified

Azure AI Fundamentals

FNU ESHANT GARG

Has successfully completed the requirements to be recognized as a Microsoft Certified: Azure AI Fundamentals.

Date of achievement: August 14, 2020



Satya Nadella
Chief Executive Officer



Certification number: H722_301



Eshant Garg

Azure Architect, Advisor, Trainer

LinkedIn: [in/eshantgarg](https://www.linkedin.com/in/eshantgarg)

Intended Audience

- Anyone who wants to clear AI-900 exam
- Anyone who wants to learn basics of Artificial Intelligence

Prerequisite

- Absolutely no prerequisite

Language

- Comfortable in English and Indian accent

What includes?

- 8+ hrs. of video content, Practice test, quizzes etc.
- PPT, Demo resources and other study material
- Certificate of course completion
- Full lifetime access
- 30-days Money-Back Guarantee
- First module is available to watch for free



AI-900 Exam Info

AI-900 Exam Details

- Exam Duration: 60 Minutes
- Number of Questions: 50 (40-60)
- Passing marks – 700/1000 points



Types of question

- Multiple choice question
- Multiple select question
- Drop down
- True/False

Do NOT have

- Case studies
- Labs

General Exam Tips

- Mark for review
- Eliminate wrong answers
- Look for keyword
- Marking system - 700 points out of 1000 points, NOT 70%
 - Partial correct answer also have points
- No negative marking
- Comment question

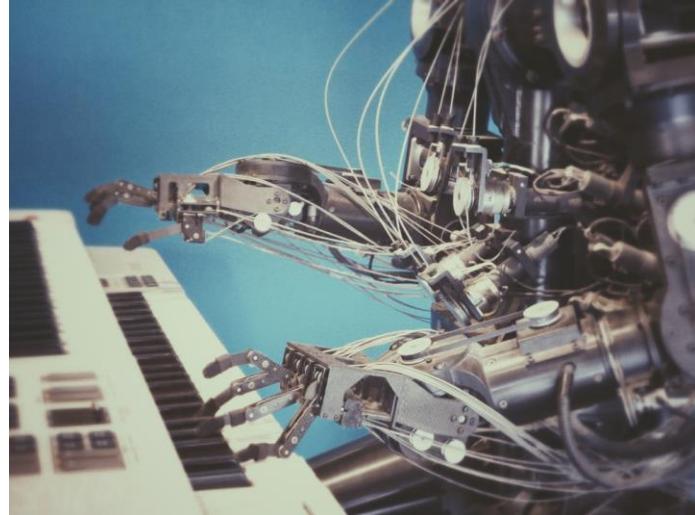


Artificial Intelligence

Types of Intelligence



Natural Intelligence



Artificial Intelligence



Artificial Intelligence

The ability of a machine
to replicate natural intelligence

Artificial Intelligence

The ability of a machine to perceive an environment and to choose actions that maximize the expected likelihood of achieving a goal

Applications of A.I

AI in Customer Service

FAQ generators

Customer support
chatbots

Telephone voice
assistants

AI in Finance

Trading algorithms

Fraud detection

Portfolio
management

AI in Healthcare

Diagnostic tools

Treatment
recommendation

Prescription
Verification

AI in Manufacturing

Product design

Industrial robots

Defect detection

AI in Marketing

Advertisement
optimization

Sentiment analysis

Product
recommendation

AI in Transportation

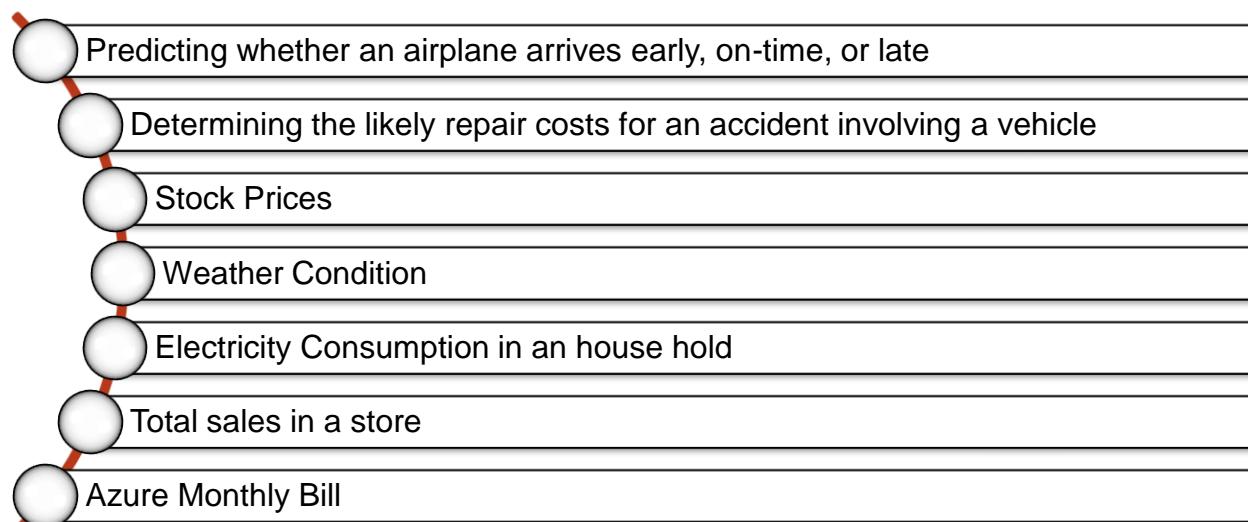
Warehouse robots

Route optimization

Delivery drones

Prediction and Forecasting

- **Prediction** – Indicating what can happen in future
- **Forecasting** - Prediction which uses data from previous events
- **Exam** – They will give you scenario and you need to figure out if it is Prediction/Forecasting workload.

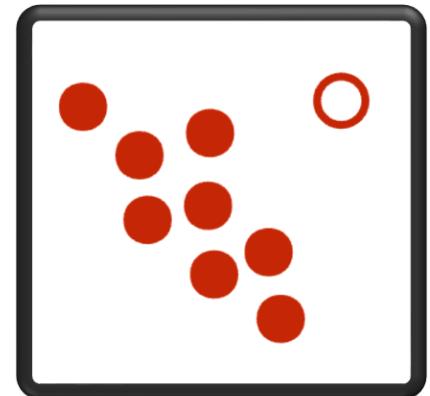


Identify features of
Anomaly Detection workload



Anomaly Detection

- Anomaly Detection is the process of using machine learning to find unexpected values or events
- A machine learning based technique that analyzes data over time and identifies unusual changes.
- Example: Unusual usage pattern in credit card transaction
- Example: Could be your heartbeat, could be sensor from your IOT device



Anomaly Detection

Statement	True	False
Anomalies can be detected by AI as they occur in real time.		
Anomalies can be detected by AI throughout a historical dataset.		
Anomaly detection boundaries that are automatically created by AI are immutable.		
Anomaly detection enables pre-emptive action to be taken before a problem occurs.		
Anomaly detection predicts when problems will occur.		
Anomaly detection analyzes data over time.		

Identify Computer Vision workload

Computer Vision is an area of AI that extract information from video or images

Computer Vision Workload

Statement	True	False
Computer Vision can be used to analyze static images.		
Computer Vision can be used to analyze live video streams.		
Computer Vision can be used to analyze live audio streams.		

Natural Processing Language

Understand written and spoken language

Natural Processing Language

NPL enables you to:

- Interpret commands and determine appropriate actions.
- Automatically translate spoken or written phrases between languages.
- Interpret spoken language, and synthesize speech responses.
- Analyze and interpret text in documents, email messages, and other sources.



Question: Analyzing customer feedback on an ecommerce website to determine whether it is positive or negative? Is this scenario an example of the natural language processing AI workload? YES/NO

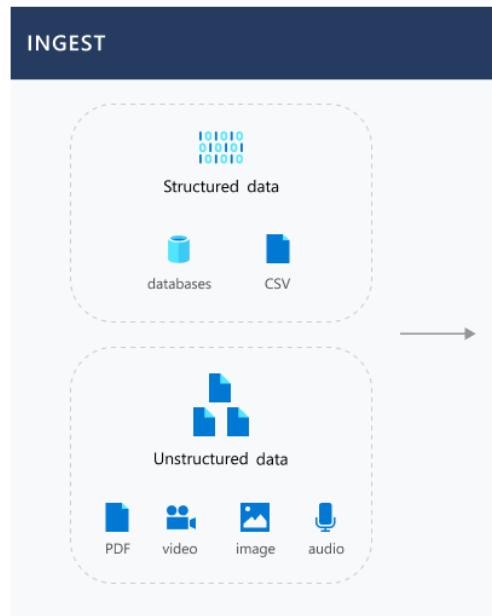
knowledge mining workloads



Knowledge Mining

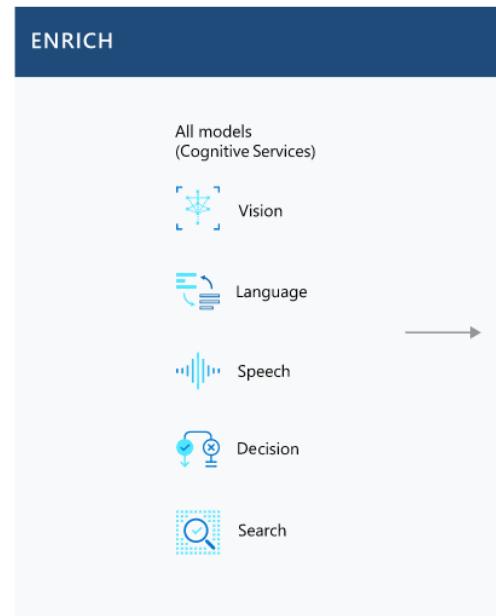
STEP 1

Ingest content from a range of sources, using connectors to first and third-party data stores.



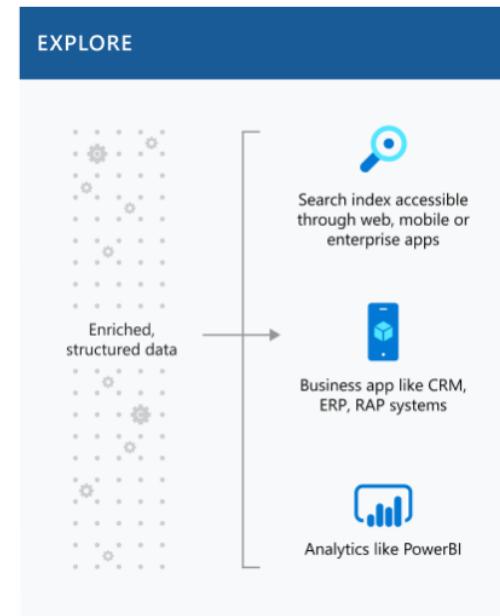
STEP 2

Enrich the content with AI capabilities that let you extract information, find patterns and deepen understanding.



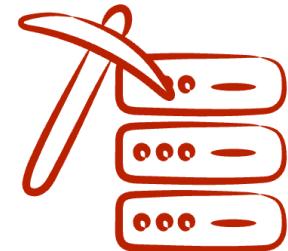
STEP 3

Explore the newly indexed data via search, bots, existing business applications and data visualisations.



Knowledge Mining

- Knowledge Mining uncovers hidden insights in your data.
 - Knowledge Mining uses a combination of AI services to extract meaning and relationships from large amounts of information.
 - This information can be held in structured and unstructured data sources, documents, and databases.
- **Question:** Extracting key insights from structured and unstructured data sources is a feature of



Identify conversational AI workloads

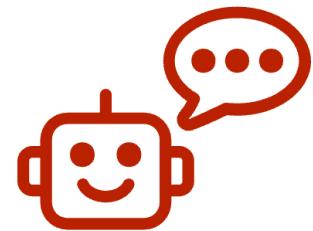


Conversational AI

- AI based solutions where AI agents participate in conversations with humans.
- Most common example: chatbots to manage dialogs with users

Bots can be the basis of AI solutions for:

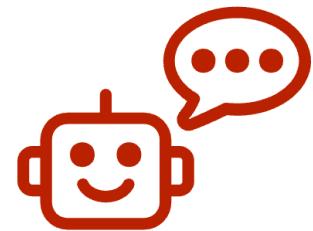
- Customer support for products or services.
- Reservation systems for restaurants, airlines, cinemas, and other appointment based businesses.
- Health care consultations and self-diagnosis.
- Home automation and personal digital assistants.



Conversational AI

Question: For which two of these scenarios should you use Conversational AI? Each correct answer presents a complete solution. Choose the correct answers

- a) Translating speech from one language to another.
- b) Making a travel reservation.
- c) Detecting a change in hospital infection rates.
- d) Detecting spam in emails.
- e) Answering frequently asked questions.



Identify guiding principles for
responsible AI

Guiding Principles

- The prevalence of AI causes some ethical and moral challenges
- These six principles are designed to ensure that AI applications provide solutions **without any unintended negative consequences**
- Decisions that are harmful to society at large
- Decisions that are illegal (or at least, go against social values)



Guiding principles of responsible AI

Six Principles Guiding Microsoft Responsible AI Development and Use



Fairness



Reliability and safety



Privacy and security



Inclusiveness



Transparency



Accountability

Fairness

AI systems should treat all people fairly without incorporating any bias based on gender, ethnicity, or other factors that might result in an unfair advantage or disadvantage to specific groups of applicants.

Examples:

- Bank loan approval application
- Medical treatment
- Employment



How to design?

- Developers should use training datasets that reflect the diversity of society.
- Developers should also design AI models in ways that allow them to learn and adapt over time without developing biases.

Question: Deploying an AI service that monitors people of certain ethnicity for closer inspection in a retail store is a violation of which Microsoft responsible AI principle?

Question: Cultural denigration is a violation of which Microsoft responsible AI principle? ²¹

Reliability and safety

- AI systems should operate reliably, safely, and consistently.
- Ensure that AI systems operate as they were originally designed, respond to unanticipated conditions and resist harmful manipulations.
- Unexpected Conditions
 - How does the military unmanned drone operate when the GPS is down?
 - How does the self-driving car operate at night? In a rainstorm? In a snowstorm?
- Developer consideration?
 - Rigorous testing and deployment management processes
 - Operate, maintain, and protect their AI systems over the lifespan of their use
- **Question:** When developing an AI system for self driving cars, which Microsoft principle for Responsible AI should be applied to ensure consistent performance during unexpected circumstances?
- **Question:** While developing an AI system you encountered a situation where the AI system should be ingested with unusual and missing values. Which Microsoft guiding principle for responsible AI you should consider?



Privacy and Security

- AI systems should be secure and respect privacy.
- Datasets may contain sensitive personal or business details that must be kept private
- Many countries and regions in the world are developing new standards and laws to try to protect the data of its citizens
 - Provide consumers with information and controls over the collection, use and storage of their data
- Developer consideration?
 - Robust compliance processes to ensure that data collected and used by our AI systems is handled responsibly.
- **Question:** Fill the Microsoft guiding principles for responsible AI to the appropriate descriptions.

Provides consumers with information and controls over the collection use and storage of their data



Inclusiveness

- At Microsoft, we firmly believe **everyone should benefit from intelligent technology**
- AI should bring benefits to all parts of society, regardless of physical ability, gender, sexual orientation, ethnicity, or other factors.
- Developer consideration?
 - Inclusive design practices can help system developers understand and address potential barriers in a product environment that could unintentionally exclude people.
- **Question:** Your company is exploring the use of voice recognition techniques in its smart home devices. The company wants to identify any barriers that might unintentionally leave out specific user groups? This is an example of which Microsoft guiding principle for responsible AI?
- **Question:** A media company is implementing an AI system that entitles everyone including people with disabilities such as vision impairment, deaf or hard of hearing. Identify the Microsoft guiding principle for responsible AI which the company is trying to implement.



Transparency

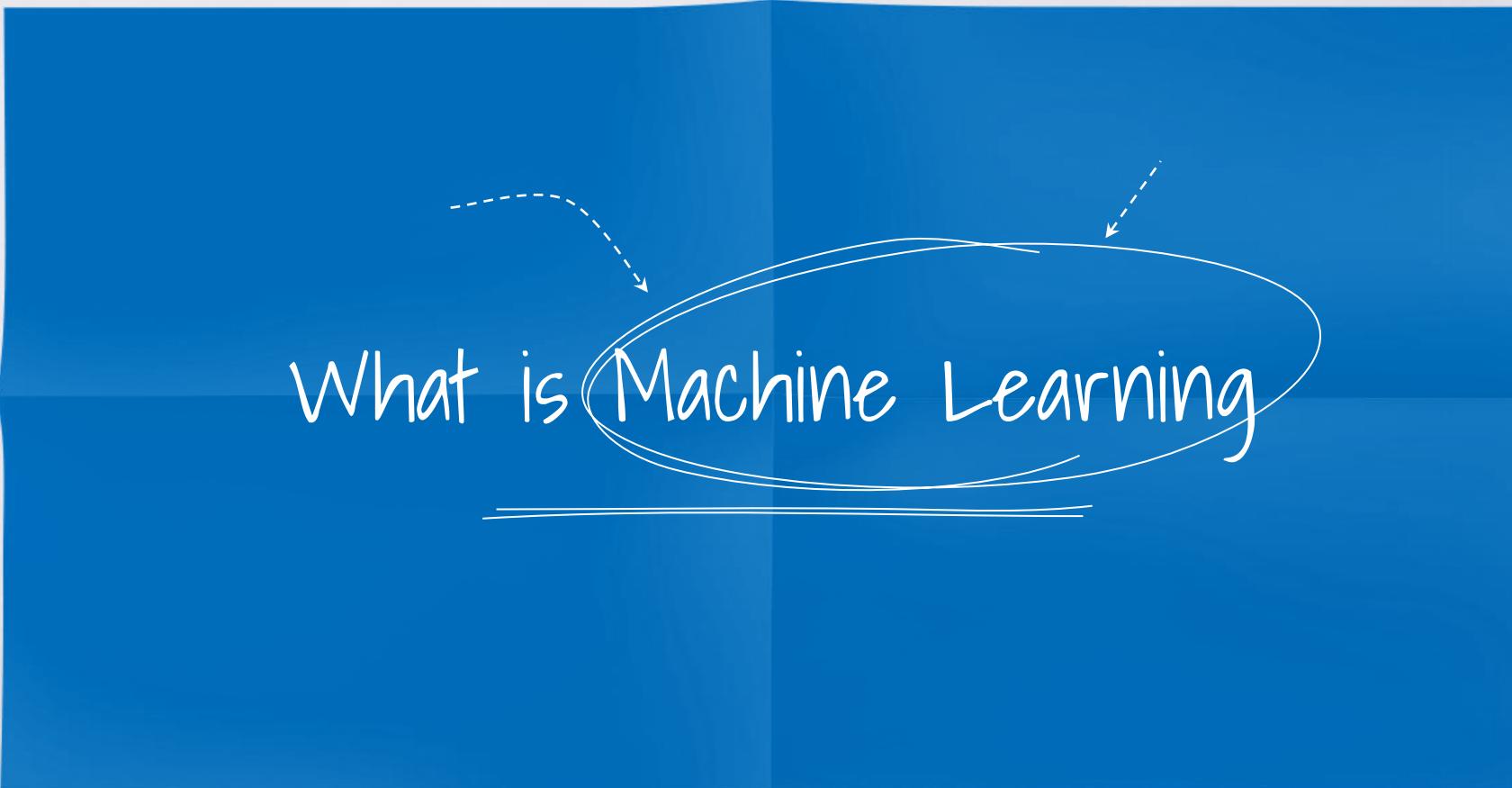
- It is critical that people understand how AI system has made decisions.
- Users should be made fully aware of the purpose of the system, how it works, and what limitations may be expected.
- For example:
 - If AI application rejected job application, or life insurance or bank loan. You should be able to explain why they were rejected? else system lack transparency.
- Developer consideration?
 - You should design system such that you can overwrite AI decision if required.
- **Question:** Ensuring users are aware of the limitations of AI-based applications that they are using is an example of _____ responsible AI principle.



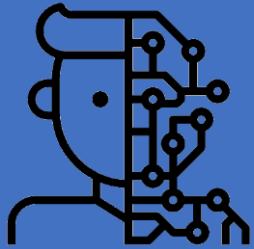
Accountability

- People should be accountable for AI systems. Designers and developers of AI-based solution should work within a framework of governance and organizational principles that ensure the solution meets ethical and legal standards that are clearly defined.
- For example:
 - Deny people consequential services like healthcare or employment, create risk of physical or emotional harm, or infringe on human rights.
- Developer consideration?
 - AI systems are not the final authority on any decision that impacts people's lives, humans maintain meaningful control over these autonomous AI systems.
 - Organizations should also have a dedicated internal review process., Regularly improve the model.
- **Question:** You are developing a solution based on facial recognition. You have to ensure that the AI-based solution meets ethical and legal standards that advocate regulations on people civil liberties and works within a framework of governance and organizational principles. The Microsoft guiding principle for responsible AI considered is?



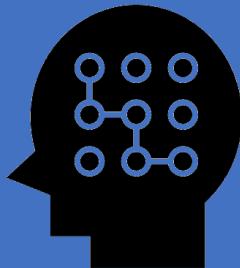


What is Machine Learning



What machine learning does?

- Find patterns in data
- Uses those patterns to predict the future
- Examples:
 - Detecting credit card Fraud
 - Determine whether a customer is likely to switch to a competitor
 - Deciding when to do preventive maintenance on a factory robot



What does it mean to learn?

- How did you learn to read?
- Learning requires:
 - Identity patterns
 - Recognizing those patterns when you see them again

“This is what machine learning does”

Finding Patterns: A Simple Example

Name	Amount	Fraudulent
Amit	\$3200	No
Rahul	\$1300	Yes
Ramesh	\$5700	Yes
Vinay	\$5700	No



What's the pattern for fraudulent transactions?

Finding Patterns: Another Example

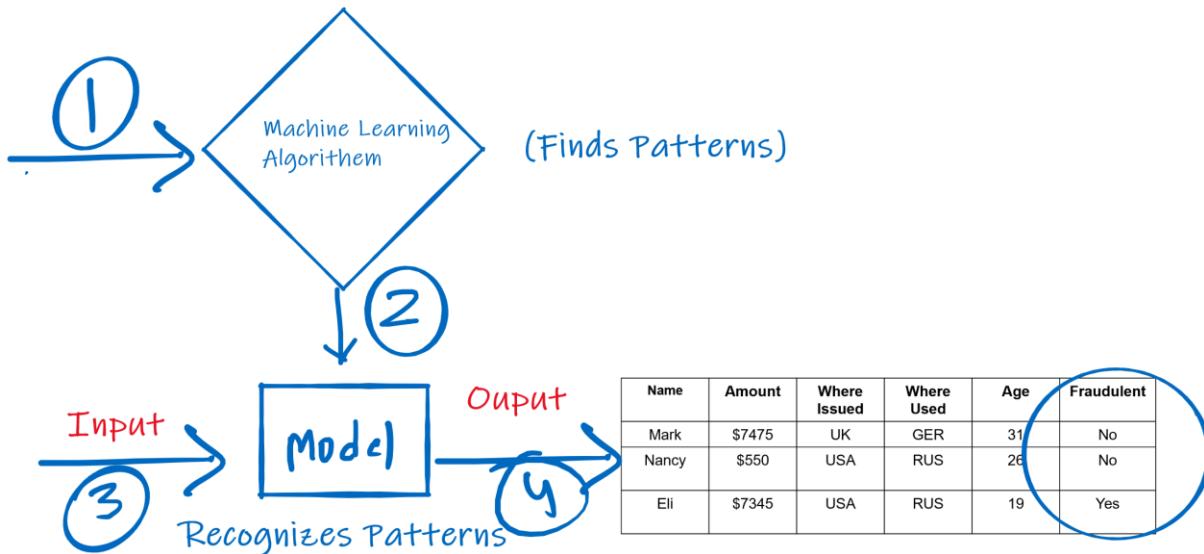
Name	Amount	Where Issued	Where Used	Age	Fraudulent
Sameer	\$2500	USA	USA	23	No
Payal	\$2394	USA	RUS	27	Yes
Piyush	\$1009	USA	RUS	25	Yes
Amit	\$8488	FRA	USA	63	No
Peter	\$298	AUS	JAP	59	No
Jones	\$3150	USA	RUS	43	No
Harry	\$8155	USA	RUS	25	Yes
Mark	\$7475	UK	GER	31	No
Nancy	\$550	USA	RUS	26	No
Eli	\$7345	USA	RUS	19	Yes

Machine Learning in a Nutshell

(Contain Pattern)

Name	Amount	Where Issued	Where Used	Age	Fraudulent
Shameer	\$2500	USA	USA	23	No
Payal	\$2394	USA	RUS	27	Yes
Piyush	\$1009	USA	RUS	25	Yes
Amit	\$8488	FRA	USA	63	No
Peter	\$298	AUS	JAP	59	No
Jones	\$3150	USA	RUS	43	No
Harry	\$8155	USA	RUS	25	Yes

Name	Amount	Where Issued	Where Used	Age	Fraudulent
Mark	\$7475	UK	GER	31	?
Nancy	\$550	USA	RUS	26	?
Eli	\$7345	USA	RUS	19	?



Relationship between AI and ML

Artificial Intelligence

An umbrella term, which we can loosely describe as:
“all the various techniques we might use to make a
computer do something smart”

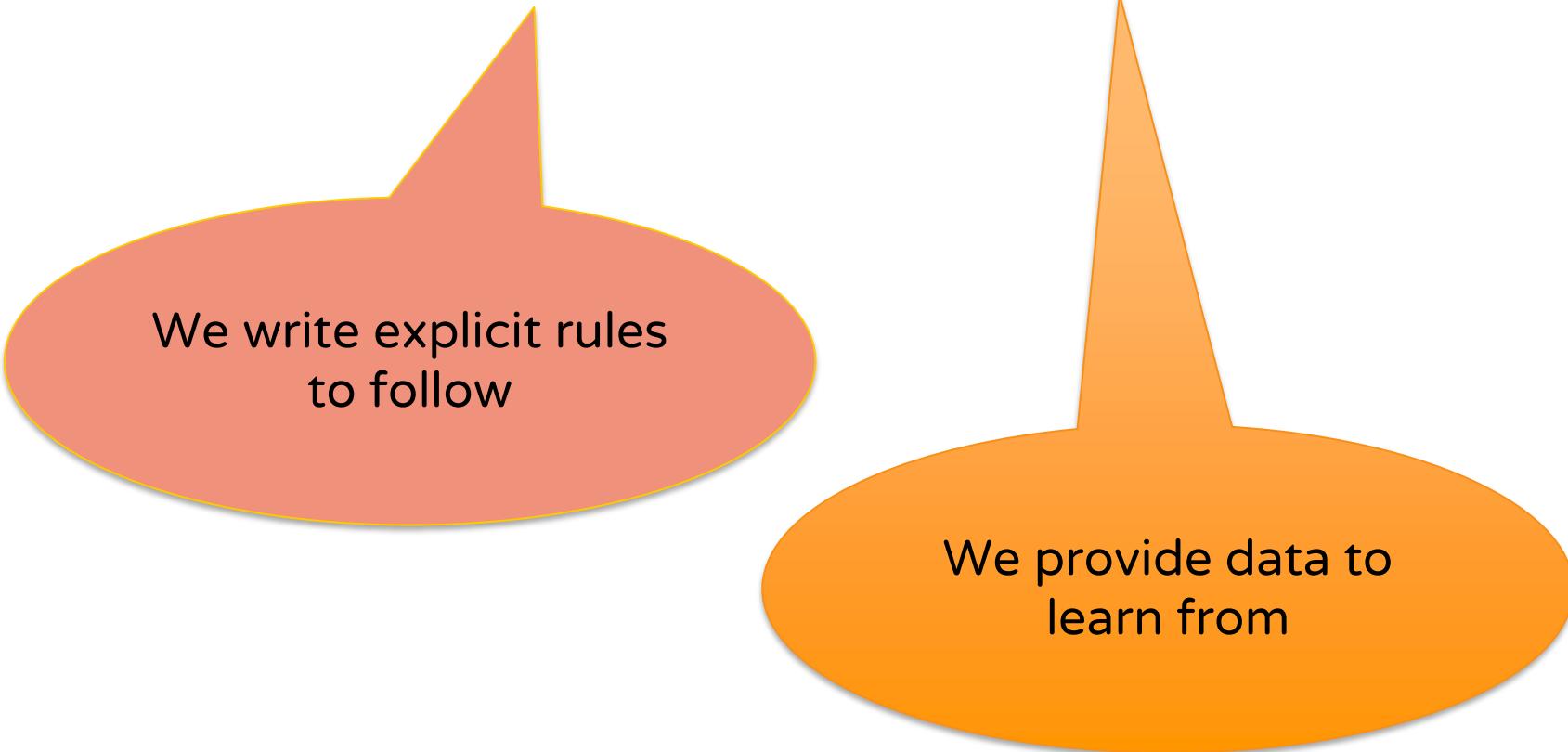
Machine Learning

A successful subset of AI that focuses on
learning from data, not on programming explicit
rules to follow

Rule based programming

vs Machine Learning

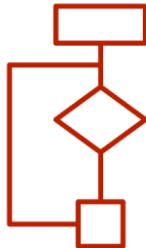
Rule based Programming vs ML



We write explicit rules
to follow

We provide data to
learn from

Rule based Analysis



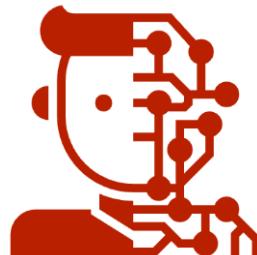
Problem statement is fairly simple

Rules are straightforward and can be easily codified

Rules can change frequently

Few problem instances to train ML model

ML based Analysis



Problem statement is reasonably complex

Hard to find patterns using visualizations and other exploratory tools

Decision variables sensitive to data, need to change as new information is received

Large corpus available to train models

ML based and Rule based Models

ML - based

- Dynamic – alter output based on patterns in data
- Expert skill not needed, need an intuition for how models work
- To update model, update corpus
- Large, high-quality data corpus
- Can not operate on a single problem instance

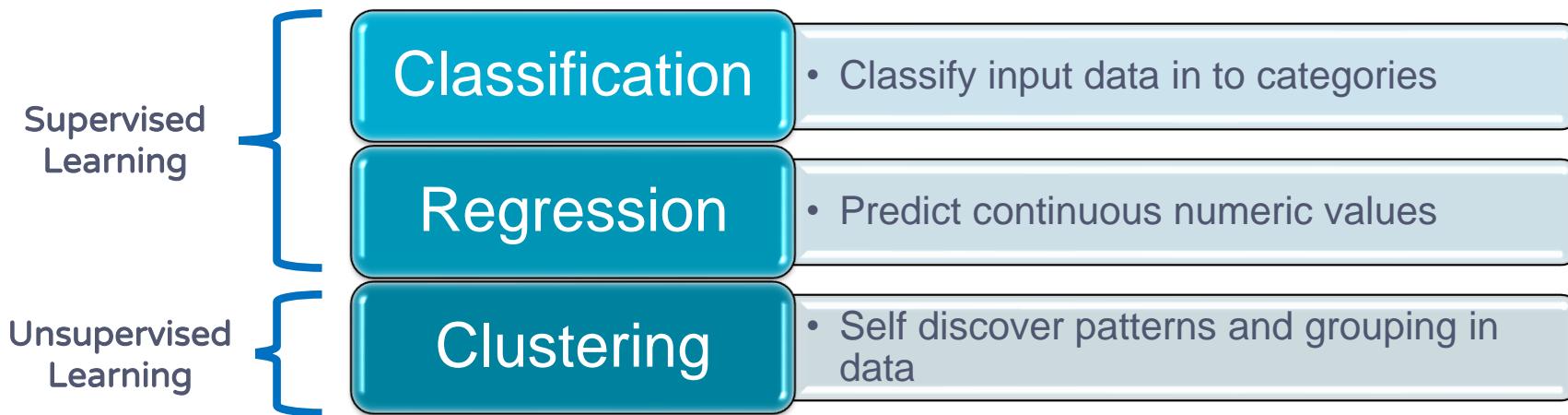
Rule - based

- Static – rules are applied independent of data
- Experts vital for formulating rules, experts based on problem
- To update model, need to update rules i.e. record model
- No corpus required
- Can operate on isolated problem instances

Machine Learning types



Machine Learning Types



Classification

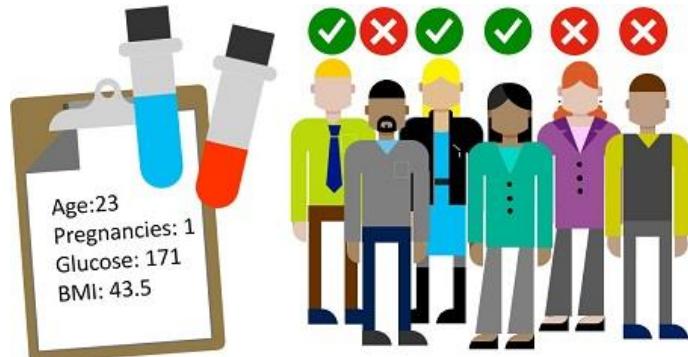
- Classify input data into categories
- Make predictions in a non-continuous form
- Classification is binary (either A or B) or multiclass (A or B or C ...etc.)
- Supervised learning

Examples: Binary classification

- Email: Spam or Not Spam?
- Identify sentiment as positive or negative.
- Determine whether a patient's lab sample is cancerous.

Examples: Multiclass classification

- Email filters as spam, junk, or good.
- Stocks: Buy, sell or hold?
- Images: Cat, dog or mouse?
- Positive, negative or neutral sentiments?



Classification

Features

Label

	Id	PatientID	Pregnancies	PlasmaGlucose	DiastolicBloodPr...	TricepsThickness	SerumInsulin	BMI	DiabetesPedigree	Age	Diabetic
1	1354778	0	171	80	34	23	43.50972593	1.213191354	21	0	0
2	1147438	8	92	93	47	36	21.24057571	0.158364981	23	0	0
3	1640031	7	115	47	52	35	41.51152348	0.079018568	23	0	0
4	1883350	9	103	78	25	304	29.58219193	1.282869847	43	1	1
5	1424119	1	85	59	27	35	42.60453585	0.549541871	22	0	0
6	1619297	0	82	92	9	253	19.72416021	0.103424498	26	0	0
7	1660149	0	133	47	19	227	21.94135672	0.174159779	21	0	0
8	1458769	0	67	87	43	36	18.2777226	0.23616494	26	0	0
9	1201647	8	80	95	33	24	26.62492885	0.443947388	53	1	1
10	1403912	1	72	31	40	42	36.88957571	0.103943637	26	0	0
11	1943830	1	88	86	11	58	43.22504089	0.230284623	22	0	0
12	1824483	3	94	96	31	36	21.29447943	0.259020482	23	0	0
13	1848869	5	114	101	43	70	36.49531966	0.079190164	38	1	1
14	1669231	7	110	82	16	44	36.08929341	0.281276159	25	0	0
15	1683688	0	148	58	11	179	39.19207553	0.160829008	45	0	0
16	1738587	3	109	77	46	61	19.84731197	0.204345272	21	1	1
17	1884264	3	106	64	25	51	29.0445728	0.589188017	42	1	1
18	1485251	1	156	53	15	226	29.78619164	0.203823525	41	1	1
19	1536832	8	117	39	32	164	21.23099598	0.089362745	25	0	0
20	1438701	3	102	100	25	289	42.18572029	0.175592826	43	1	1

Regression

- Predict a numeric value, typically in a continuous form
- learning from labeled historical data to predict or forecast new values
- Supervised learning

Examples:

- Given past stock data predict price tomorrow
- Given location and attributes of a home predict price



Regression

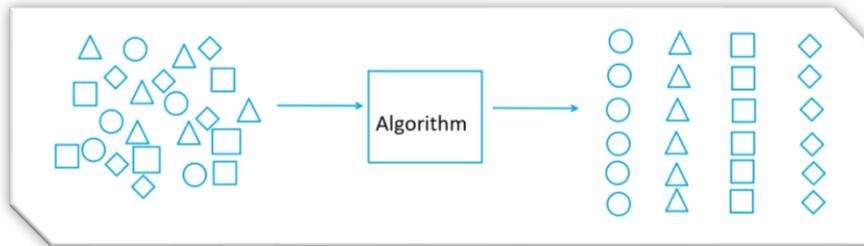
Features

Label



symboling	normalized-losses	make	fuel-type	aspiration	num-of-doors	body-style	drive-wheels	engine-location	wheel-base	length	width	height	curb-weight	engine-type	num-of-cylinders	engine-size	fuel-system	bore	stroke	compression-ratio	horsepower	peak-rpm	city-mpg	highway-mpg	price
3	NaN	alfa-romero	gas	std	two	convertible	rwd	front	88.6	168.8	64.1	48.8	2548	dohc	four	130	mpfi	3.47	2.68	9	111	5000	21	27	13495
3	NaN	alfa-romero	gas	std	two	convertible	rwd	front	88.6	168.8	64.1	48.8	2548	dohc	four	130	mpfi	3.47	2.68	9	111	5000	21	27	16500
1	NaN	alfa-romero	gas	std	two	hatchback	rwd	front	94.5	171.2	65.5	52.4	2823	ohcv	six	152	mpfi	2.68	3.47	9	154	5000	19	26	16500
2	164	audi	gas	std	four	sedan	fwd	front	99.8	176.6	66.2	54.3	2337	ohc	four	109	mpfi	3.19	3.4	10	102	5500	24	30	13950
2	164	audi	gas	std	four	sedan	4wd	front	99.4	176.6	66.4	54.3	2824	ohc	five	136	mpfi	3.19	3.4	8	115	5500	18	22	17450
2	NaN	audi	gas	std	two	sedan	fwd	front	99.8	177.3	66.3	53.1	2507	ohc	five	136	mpfi	3.19	3.4	8.5	110	5500	19	25	15250
1	158	audi	gas	std	four	sedan	fwd	front	105.8	192.7	71.4	55.7	2844	ohc	five	136	mpfi	3.19	3.4	8.5	110	5500	19	25	17710
1	NaN	audi	gas	std	four	wagon	fwd	front	105.8	192.7	71.4	55.7	2954	ohc	five	136	mpfi	3.19	3.4	8.5	110	5500	19	25	18920
1	158	audi	gas	turbo	four	sedan	fwd	front	105.8	192.7	71.4	55.9	3086	ohc	five	131	mpfi	3.13	3.4	8.3	140	5500	17	20	23875
0	NaN	audi	gas	turbo	two	hatchback	4wd	front	99.5	178.2	67.9	52	3053	ohc	five	131	mpfi	3.13	3.4	7	160	5500	16	22	NaN
2	192	bmw	gas	std	two	sedan	rwd	front	101.2	176.8	64.8	54.3	2395	ohc	four	108	mpfi	3.5	2.8	8.8	101	5800	23	29	16430
0	192	bmw	gas	std	four	sedan	rwd	front	101.2	176.8	64.8	54.3	2395	ohc	four	108	mpfi	3.5	2.8	8.8	101	5800	23	29	16925
0	188	bmw	gas	std	two	sedan	rwd	front	101.2	176.8	64.8	54.3	2710	ohc	six	164	mpfi	3.31	3.19	9	121	4250	21	28	20970

Clustering



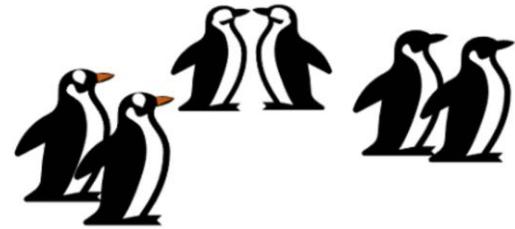
- Find cases with similar characteristics in an unlabeled dataset and group them together
- Unsupervised learning

Examples:

- Document discovery – find all documents related to homicide cases
- Social media ad targeting – find all users who are interested in sports

Clustering

Features



#	Id	CulmenLength	CulmenDepth	FlipperLength	BodyMass	Species
1	39.1		18.7	181	3750	0
2	39.5		17.4	186	3800	0
3	40.3		18	195	3250	0
4	null		null	null	null	0
5	36.7		19.3	193	3450	0
6	39.3		20.6	190	3650	0
7	38.9		17.8	181	3625	0
8	39.2		19.6	195	4675	0
9	34.1		18.1	193	3475	0
10	42		20.2	190	4250	0
11	37.8		17.1	186	3300	0
12	37.8		17.3	180	3700	0
13	41.1		17.6	182	3200	0
14	38.6		21.2	191	3800	0
15	34.6		21.1	198	4400	0
16	36.6		17.8	185	3700	0
17	38.7		19	195	3450	0
18	42.5		20.7	197	4500	0
19	34.4		18.4	184	3325	0
20	46		21.5	194	4200	0

Supervised vs Unsupervised Learning



Classification

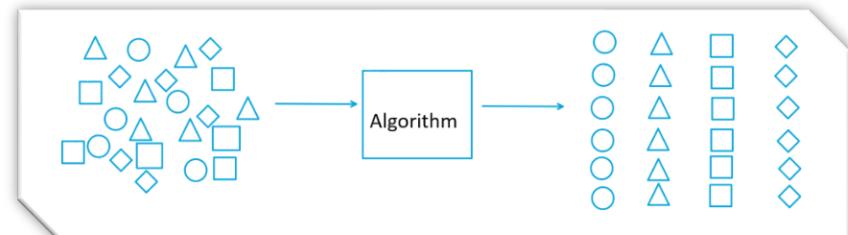


Regression



Supervised Learning

Unsupervised Learning



Clustering

Figure out right machine learning type?

- Predicting the online sales volume for the next financial quarter?
- Analyzing X-ray images to detect whether a person has pneumonia?
- Grouping together online shoppers with similar traits for targeted marketing?
- Forecasting stock market index values based on macro economic changes?
- Processing new tweets to categorize them as positive or negative?
- Predict ice cream sales based on the weather forecast?
- Determine the amount of credit to give to a customer?
- Determine if a social media post has positive or negative sentiment?
- Approve or reject a customer's application for credit?

Questions: Figure out right machine learning type?

- Predicting the online sales volume for the next financial quarter? -> **Regression**
- Analyzing X-ray images to detect whether a person has pneumonia? -> **Classification**
- Grouping together online shoppers with similar traits for targeted marketing? -> **Clustering**
- Forecasting stock market index values based on macro economic changes? -> **Regression**
- Processing new tweets to categorize them as positive or negative? -> **Classification**
- Predict ice cream sales based on the weather forecast? -> **Regression**
- Determine the amount of credit to give to a customer? -> **Regression**
- Determine if a social media post has positive or negative sentiment? -> **Classification**
- Approve or reject a customer's application for credit? -> **Classification**

Feature Engineering and Selection

Feature Selection

Features

Label

Id	PatientID	Pregnancies	PlasmaGlucose	DiastolicBloodPr...	TricepsThickness	SerumInsulin	BMI	DiabetesPedigree	Age	Diabetic
1	1354778	0	171	80	34	23	43.50972593	1.213191354	21	0
2	1147438	8	92	93	47	36	21.24057571	0.158364981	23	0
3	1640031	7	115	47	52	35	41.51152348	0.079018568	23	0
4	1883350	9	103	78	25	304	29.58219193	1.282869847	43	1
5	1424119	1	85	59	27	35	42.60453585	0.549541871	22	0
6	1619297	0	82	92	9	253	19.72416021	0.103424498	26	0

Name	Degree	Certification	Age	Experience	Location	Phone	height	Salary

Feature Selection

Feature Selection is the process where you automatically or manually select those features which contribute most to your prediction variable or output in which you are interested in.

- Feature selection has a huge impact on the performance of the model in XL
- You need to identify and remove irrelevant or partially relevant features
- **Principle** – Minimum redundancy and maximum relevance

Benefits of selecting features?

- **Reduces Overfitting:** Less redundant data means less opportunity to make decisions based on noise.
- **Improves Accuracy:** Less misleading data means modeling accuracy improves.
- **Reduces Training Time:** fewer data points reduce algorithm complexity and algorithms train faster.

Feature Engineering

- **Feature engineering** is the process of creating new features from raw data to increase the predictive power of the machine learning model.
- Engineered features capture additional information that is not available in the original feature set.
- Examples of feature engineering are aggregating data, calculating a moving average, and calculating the difference over time

Question: Feature Engineering

Question: Splitting the address field into country, city and street number can be appropriately mapped to _____ machine learning task.

- A. Feature engineering
- B. Feature selection

Question: You need to map the right Learning task for a given scenario?

“Picking temperature and pressure to train a weather model”

- A. Feature engineering
- B. Feature selection

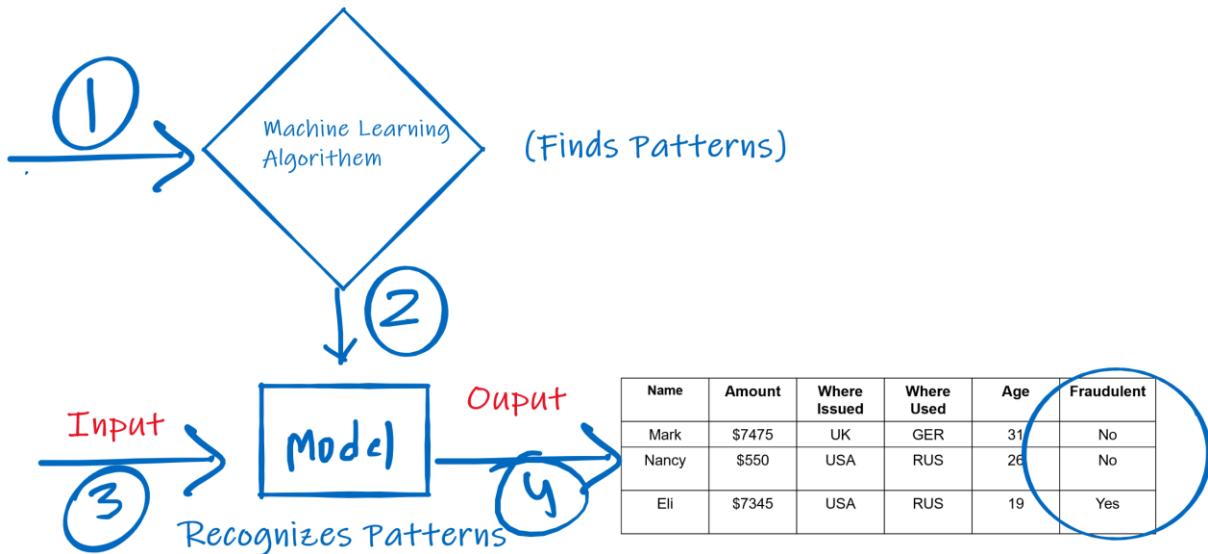
Training vs Validation vs testing
dataset

Machine Learning in a Nutshell

(Contain Pattern)

Name	Amount	Where Issued	Where Used	Age	Fraudulent
Shameer	\$2500	USA	USA	23	No
Payal	\$2394	USA	RUS	27	Yes
Piyush	\$1009	USA	RUS	25	Yes
Amit	\$8488	FRA	USA	63	No
Peter	\$298	AUS	JAP	59	No
Jones	\$3150	USA	RUS	43	No
Harry	\$8155	USA	RUS	25	Yes

Name	Amount	Where Issued	Where Used	Age	Fraudulent
Mark	\$7475	UK	GER	31	?
Nancy	\$550	USA	RUS	26	?
Eli	\$7345	USA	RUS	19	?



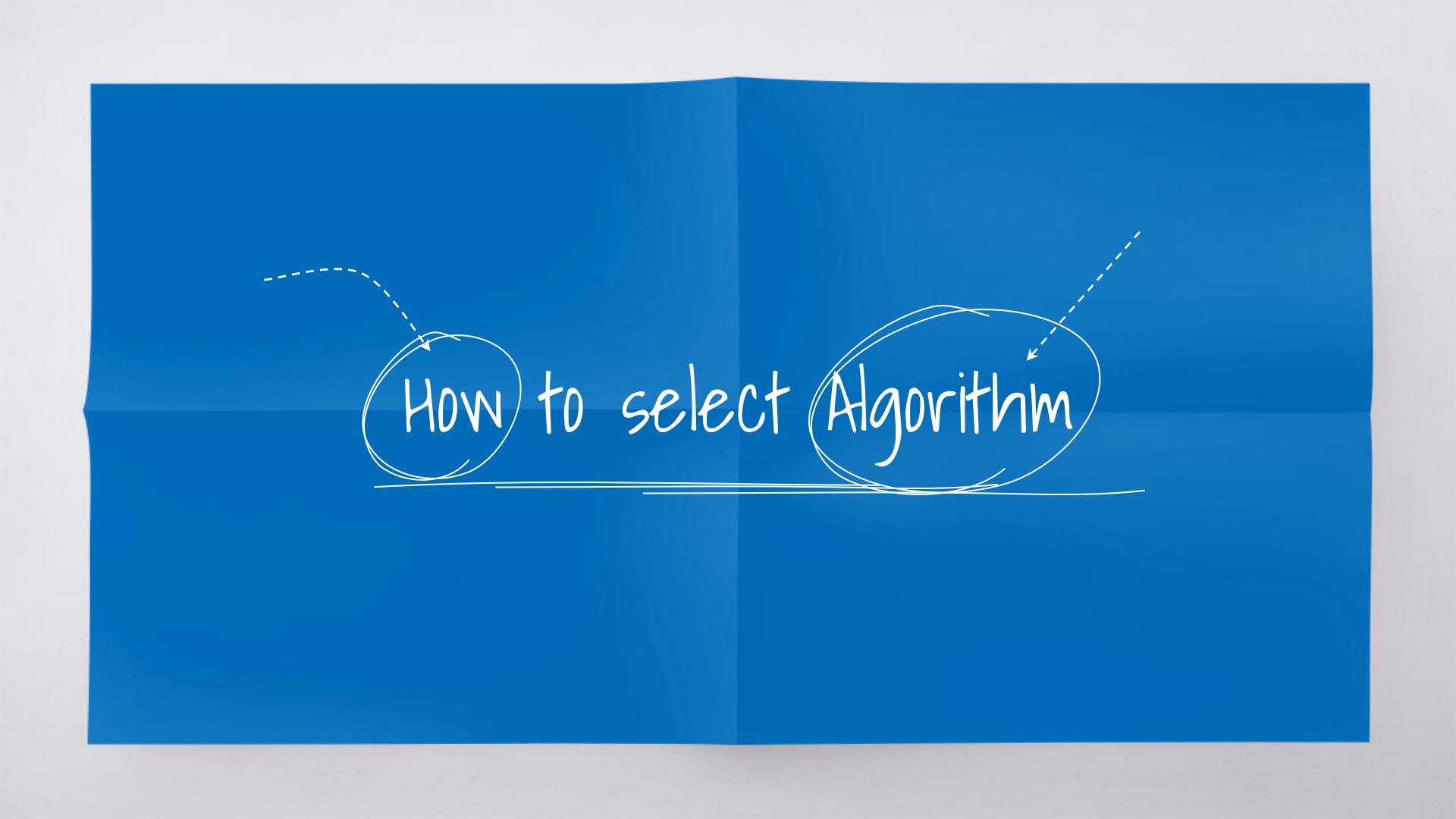
Training vs Validation vs Testing Dataset

- The **training dataset** is the sample of data used to train the model. It is the largest sample of data used when creating a machine learning model.
- The **validation dataset** is a second sample of data used to provide an evaluation of the model to see if the model can correctly predict, or classify, using data not seen before. The validation dataset is used to tune the model. . It helps to get an unbiased evaluation of the model while tuning its hyperparameters.
- A **testing dataset** is a set of data used to provide a final unbiased evaluation of the model. A test dataset is an independent sample of data and is used once a model has been completely trained with the training and validation datasets.

Question

Which two datasets do you use to build a machine learning model? Each correct answer presents part of the solution. Choose the correct answers

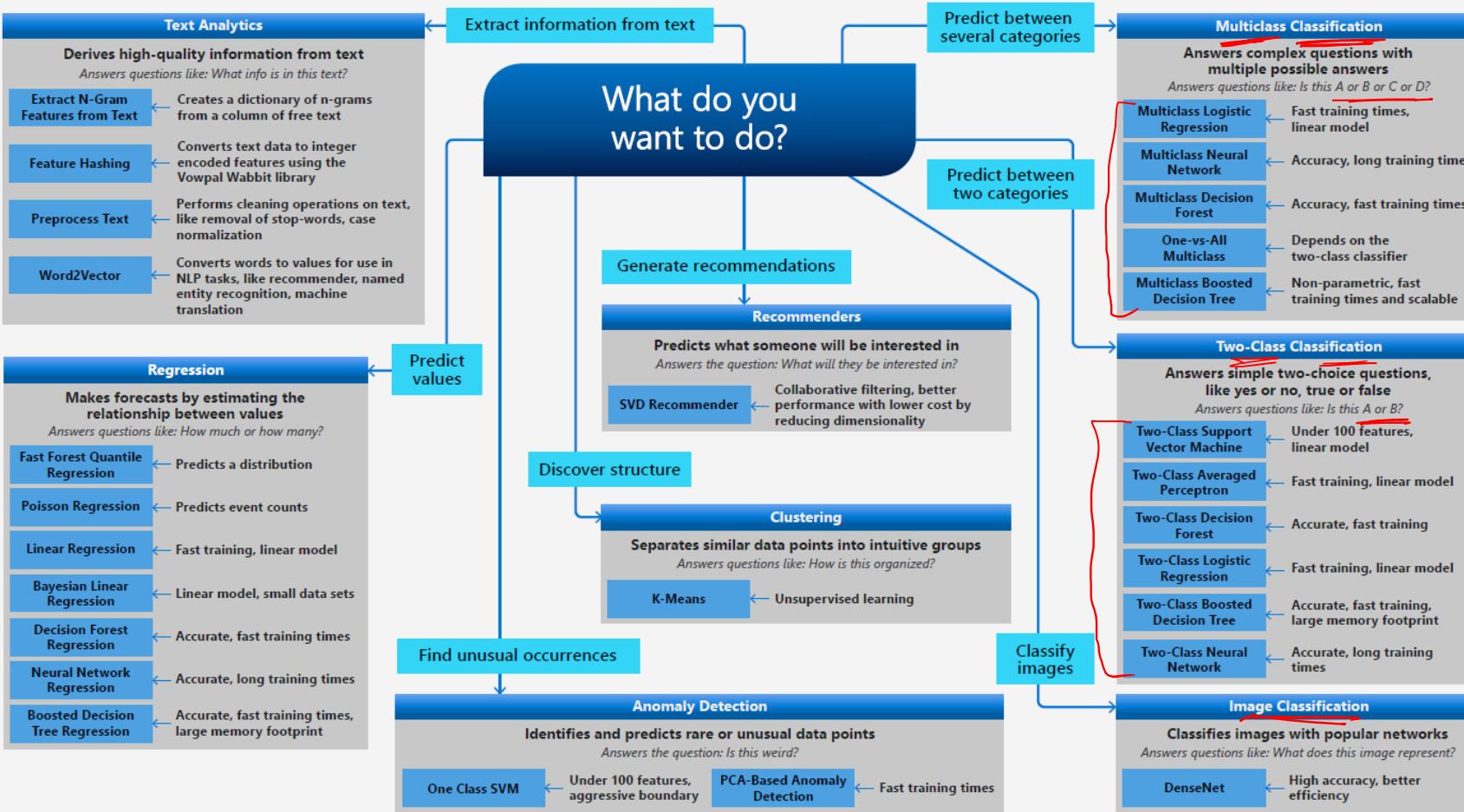
1. Training dataset
2. Azure Open Dataset
3. Validation dataset
4. Testing dataset



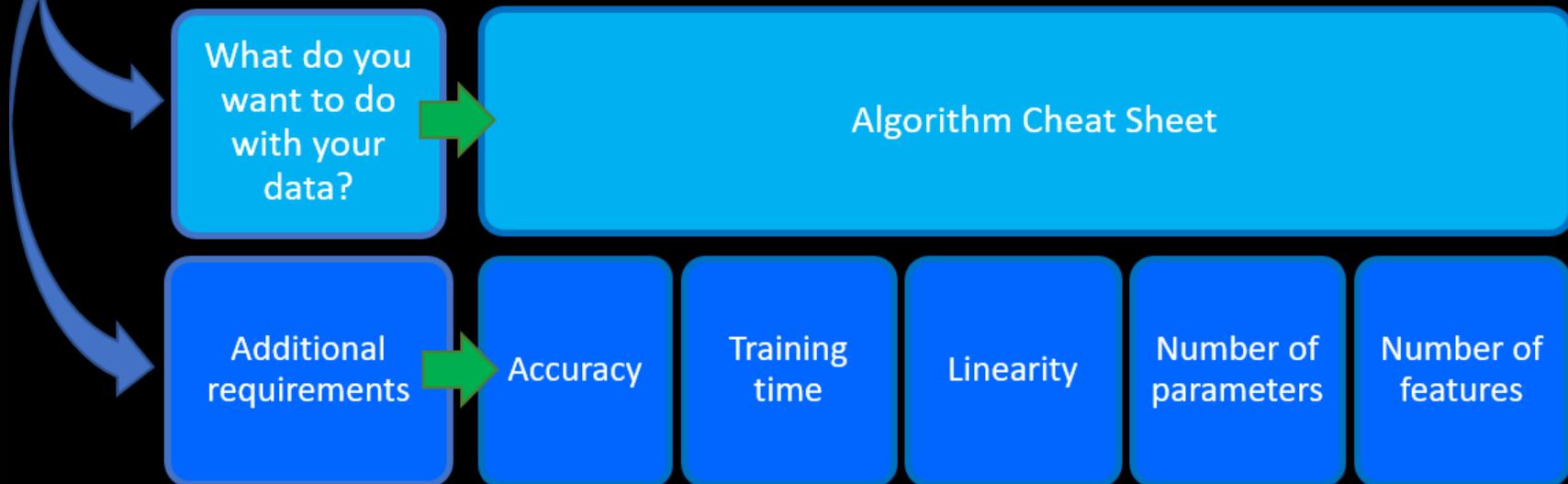
How to select Algorithm

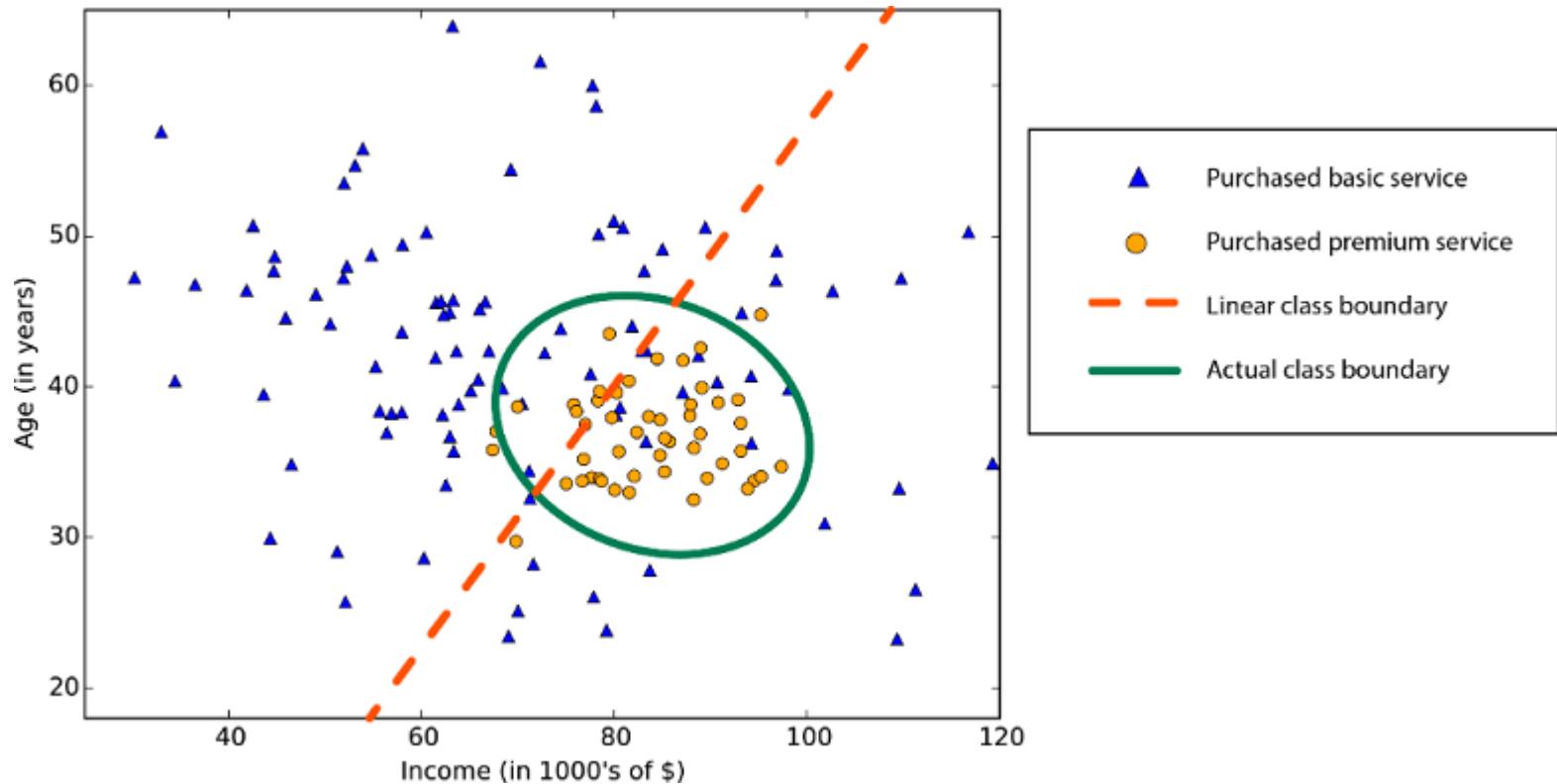
Microsoft Azure Machine Learning Algorithm Cheat Sheet

This cheat sheet helps you choose the best machine learning algorithm for your predictive analytics solution. Your decision is driven by both the nature of your data and the goal you want to achieve with your data.



How to select machine learning algorithms





Demo:

Creating a ML workspace

Workspace: Associated resources

- **Azure Storage account:** Is used as the default datastore for the workspace. Jupyter notebooks that are used with your Azure Machine Learning compute instances are stored here as well.
- **Azure Container Registry:** Registers docker containers that you use during training and when you deploy a model.
- **Azure Application Insights:** Stores monitoring information about your models.
- **Azure Key Vault:** Stores secrets that are used by compute targets and other sensitive information that's needed by the workspace.

Demo: Designing a pipeline
Regression Model

Machine Learning Studio

- **Experiments** are training runs you use to build your models.
- **Pipelines** are reusable workflows for training and retraining your model.
- **Datasets** aid in management of the data you use for model training and pipeline creation.
- Once you have a model you want to deploy, you create a registered **model**.
- Use the registered model and a scoring script to create a **deployment endpoint**.
- **Compute targets** are used to run your experiments.
 - ✓ **Compute Instances:** A compute instance is used as a compute target for authoring and training models for development and testing purposes.
 - ✓ **Compute Clusters:** Scalable clusters of virtual machines for on-demand processing of experiment code, for running batch inference on large amounts of data.
 - ✓ **Inference Clusters:** Deployment targets for predictive services that use your trained models.
 - ✓ **Attached Compute:** Links to existing Azure compute resources, such as Virtual Machines or Azure Databricks clusters.

Metric: Regression

- **Mean Absolute Error (MAE):** The average difference between predicted values and true values. This value is based on the same units as the label, in this case dollars. The lower this value is, the better the model is predicting.
- **Root Mean Squared Error (RMSE):** The square root of the mean squared difference between predicted and true values. The result is a metric based on the same unit as the label (dollars). When compared to the MAE (above), a larger difference indicates greater variance in the individual errors (for example, with some errors being very small, while others are large).
- **Relative Squared Error (RSE):** A relative metric between 0 and 1 based on the square of the differences between predicted and true values. The closer to 0 this metric is, the better the model is performing. Because this metric is relative, it can be used to compare models where the labels are in different units.
- **Relative Absolute Error (RAE):** A relative metric between 0 and 1 based on the absolute differences between predicted and true values. The closer to 0 this metric is, the better the model is performing. Like RSE, this metric can be used to compare models where the labels are in different units.
- **Coefficient of Determination (R2):** Coefficient of determination is a measure of the variance from the mean in its predictions. Its value varies between 0 and 1, where 1 typically indicates a perfectly fit model, while 0 indicates a random one. This metric is more commonly referred to as R-Squared.

Demo: Deploying a ML model
Regression Model

Questions: ML Studio

Question: A dataset contains attributes that have values in different units with different ranges of values. Which data preprocessing method is used to transform the values into a common scale?

- Normalization
- Binning
- Substitution
- Sampling

Question: Split data

- You can divide a dataset using regular expression.
- You can split a dataset for training/testing by rows.
- You can split a dataset for training/testing by columns.

Question: You need to hold back a dataset from model training so it can be used to estimate a model's prediction error while tuning its hyperparameters. Which dataset should you use?

- Training dataset
- Testing dataset
- Raw data
- Validation dataset

Questions: ML Studio

Question: What should you do to measure the accuracy of a trained machine learning model?

- Score the model.
- Summarize the data.
- Normalize the data.
- Create features.

Question: What should you do to measure the accuracy of the predictions and assess model fit?

- Evaluate the model.
- Detect languages.
- Score the model.
- Evaluate the probability function.

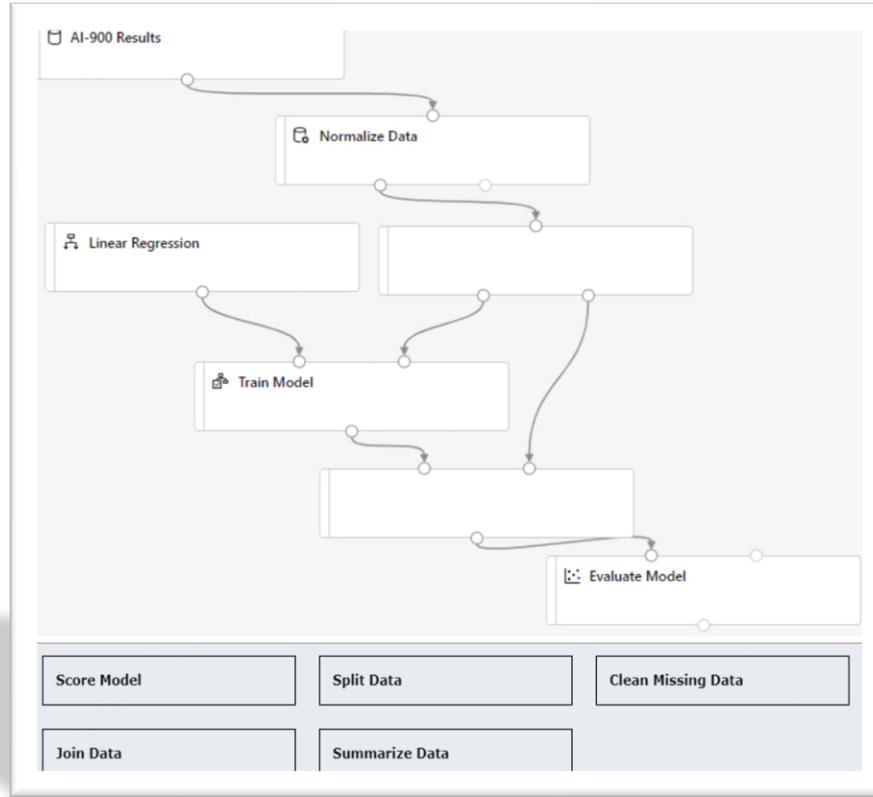


Delete Resources

Demo: Classification Model



Question: Which modules should you use to complete the pipeline? To answer, drag the appropriate module to the relevant slots. A module may be used once, more than once, or not at all.



Metric: classification

- **Accuracy:** The ratio of correct predictions (true positives + true negatives) to the total number of predictions. In other words, what proportion of diabetes predictions did the model get right?
- **Precision:** Precision is a measure of the correct positive results. Precision is the number of true positives divided by the sum of the number of true positives and false positives. Precision is scored between 0 and 1. Values closer to 1 are better.
- **Recall:** The fraction of the cases classified as positive that are actually positive (the number of true positives divided by the number of true positives plus false negatives). In other words, out of all the patients who actually have diabetes, how many did the model identify?
- **F1 Score:** F1 score is a measure combining precision and recall. F1 score is the weighted average of precision and recall (the number of true positives divided by the sum of true positives and false negatives). F-score is scored between 0 and 1. Values closer to 1 are better.
- **AUC:** measures the area under a curve that represents true positive rate over true negative rate. AUC ranges between 0 and 1. Values closer to 1 indicate that the model is performing better. AUC value of 0.4 means that the model is performing worse than a random guess. AUC values range between 0 and 1. The higher the value, the better the performance of the classification model.

Metric: classification

Question: Which two metrics can you use to evaluate classification machine learning models? Each correct answer presents a complete solution. Choose the correct answers

- A. Mean Absolute Error (MAE)
- B. Precision
- C. Recall
- D. Average Distance to Cluster Center

Question: In the evaluation of the classification model you get a value of 0.3 for the area under the curve (AUC) metrics. What does it mean?

- A. 40 percent of data is allocated to training and 60 percent to testing.
- B. 60 percent of data is allocated to training and 40 percent to testing.
- C. The model is performing worse than a random guess.
- D. The model is performing better than a random guess.

Metric: classification

Question: Which two metrics can you use to evaluate a classification machine learning model? Each correct answer presents a complete solution.

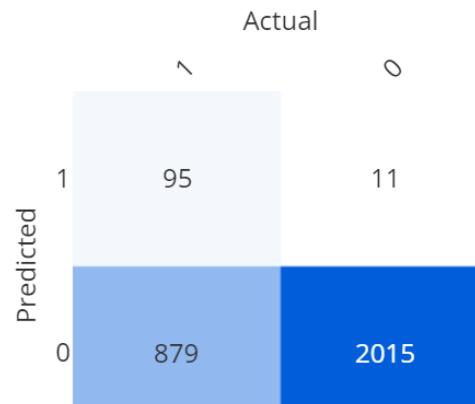
- A. Coefficient of determination
- B. Maximal Distance to Cluster Center
- C. F-score
- D. Root mean squared error (RMSE)
- E. Precision

Metric: classification

Question: You evaluate a machine learning model and it generates the matrix shown in the exhibit?

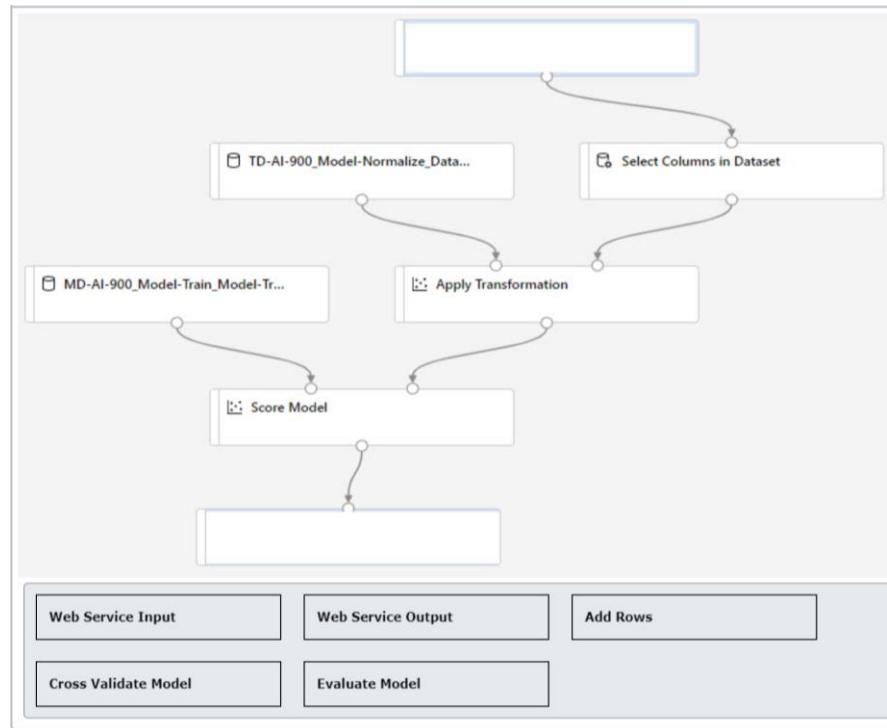
For each of the following statements, select Yes if the statement is true. Otherwise, select No

- A. The machine learning model is a classification model
- B. There are 879 false positives
- C. There are 2015 true negatives

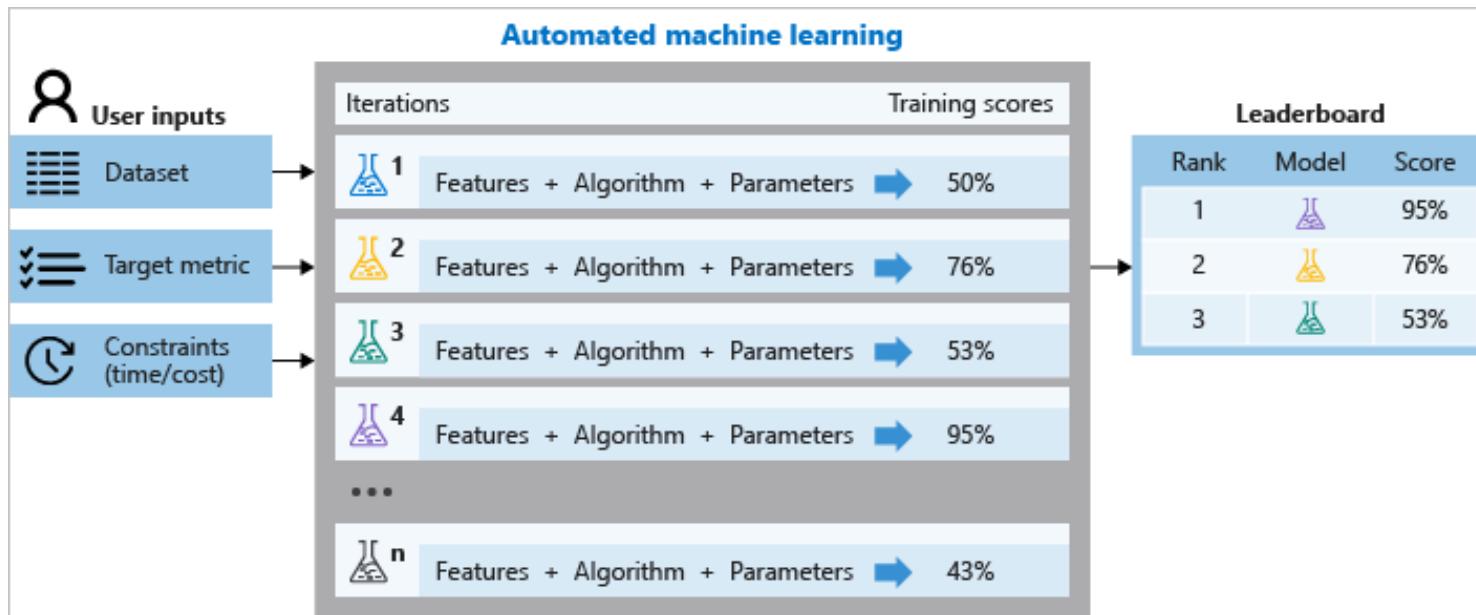


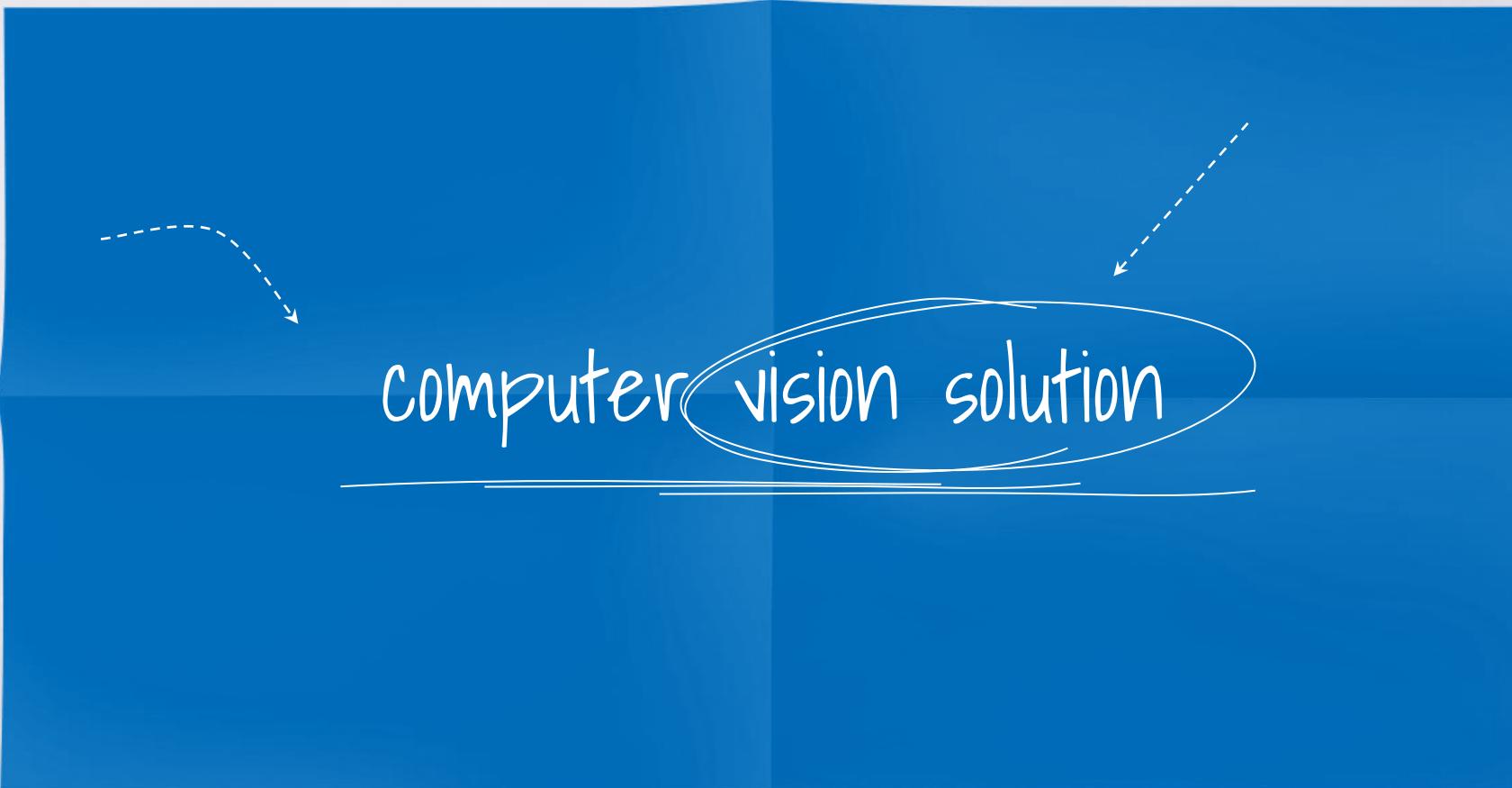
Question: You create a real-time inference pipeline from a training pipeline in Azure Machine Learning designer. You need to complete the inference pipeline.

Which modules should you use to complete the pipeline? To answer, drag the appropriate module to the relevant slots. A module may be used once, more than once, or not at all.



Automated Machine Learning





computer vision solution

Identify common types of computer vision solution:

- Identify features of **image classification** solutions
- Identify features of **object detection** solutions
- Identify features of **semantic segmentation** solutions
- Identify features of **optical character recognition** solutions
- Identify features of **facial detection, facial recognition, and facial analysis** solutions

Scenario: Retrieval of handwritten text from a student's essay?

- A. Object detection
- B. Semantic Segmentation
- C. Optical Character recognition
- D. Facial detection

Image classification

- Classify object in an image, predict which category, or class, object belongs to.
- Digital images are made up of an array of pixel values, and these are used as features to train the model based on the known image classes.
- You can feed image to pre-build model, and model will be able to predict that image
- You can also build your own custom model

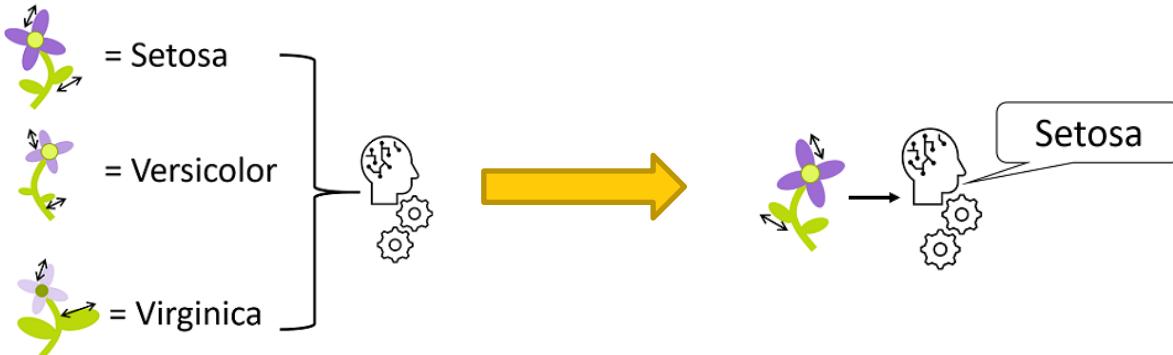


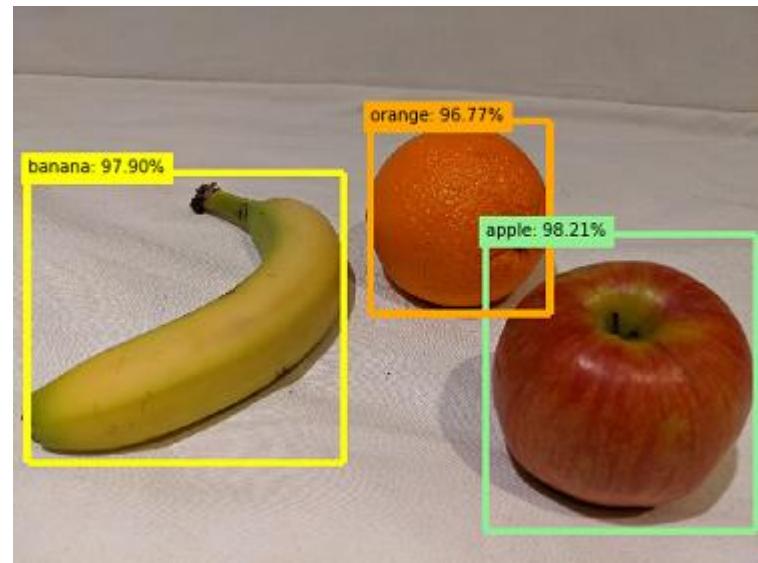
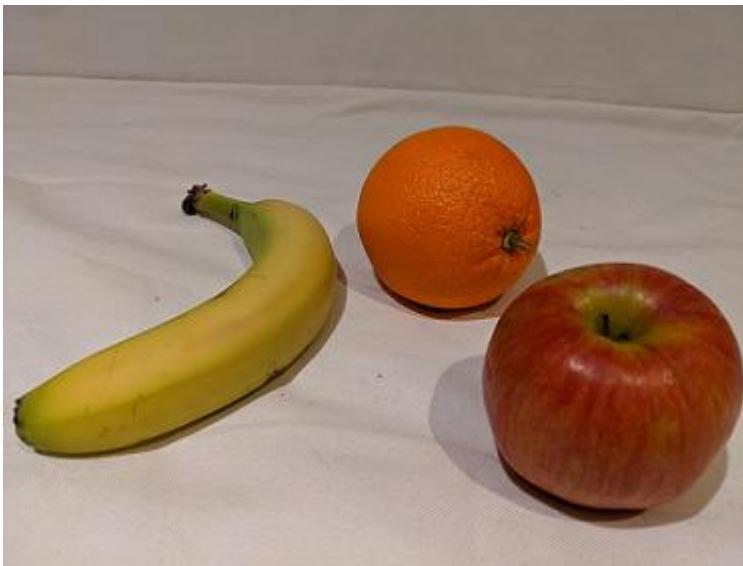
Image classification

Some potential uses for image classification might include:

- **Product identification** - performing visual searches for specific products in online searches or even, in-store using a mobile device.
- **Disaster investigation** - evaluating key infrastructure for major disaster preparation efforts. For example, aerial surveillance images may show bridges and classify them as such. Anything classified as a bridge could then be marked for emergency preparation and investigation.
- **Medical diagnosis** - evaluating images from X-ray or MRI devices could quickly classify specific issues found as cancerous tumors, or many other medical conditions related to medical imaging diagnosis.

Object Detection

Model is trained to recognize individual types of object in an image, and to identify their location in the image



Object Detection

Some sample applications of object detection include:

- Evaluating the safety of a building by looking for fire extinguishers or other emergency equipment.
- Creating software for self-driving cars or vehicles with lane assist capabilities.
- Medical imaging such as an MRI or x-rays that can detect known objects for medical diagnosis.



Difference?

Image classification is a machine learning based form of computer vision in which a model is trained to categorize images based on the primary subject matter they contain.

Object detection goes further than this to classify individual objects within the image, and to return the coordinates of a bounding box that indicates the object's location.

Semantic Segmentation

- Semantic segmentation associates each pixel in an image with a tagged object. Semantic segmentation answers the question "which pixels belong to which object?" and that paves the way towards complete scene understanding
- Use Case: Self-driving car



An example of semantic segmentation (Source: <https://blog.goodaudience.com/using-convolutional-neural-networks-for-image-segmentation-a-quick-intro-75bd68779225>)

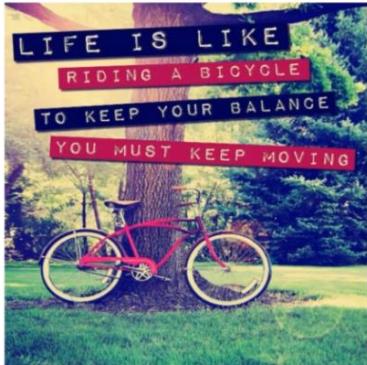
Image Classification vs Object detection vs semantic segmentation

Scenario

1. Returning bounding box coordinates for all identified animals in a photo: Classification vs Object detection vs segmentation
2. Pixel-level classification of an image content Classification vs Object detection vs segmentation
3. Retrieval of printed text from a scanned document Classification vs Object detection vs segmentation
4. Assessing the damage to a vehicle from a photograph is an example of Classification vs Object detection vs segmentation
5. Find people wearing a face mask in a room Classification vs Object detection vs segmentation

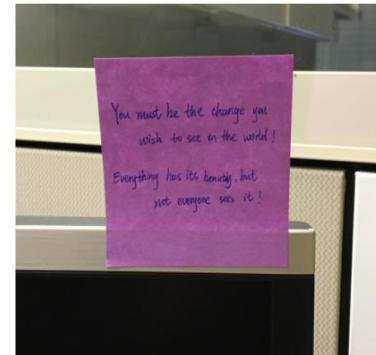
Optical Character Recognition

- Optical character recognition (OCR) is a process of extracting printed or handwritten text from the input images, PDF documents, and other sources of digitized text.
- OCR can recognize individual shapes as letters, numerals, punctuation, and other elements of text
- Uses of OCR
 - note taking
 - digitizing forms, such as medical records or historical documents
 - scanning printed or handwritten checks for bank deposits



Preview JSON

LIFE
IS
LIKE
RIDING
A BICYCLE
TO
KEEP
YOUR BALANCE
YOU MUST KEEP MOVING



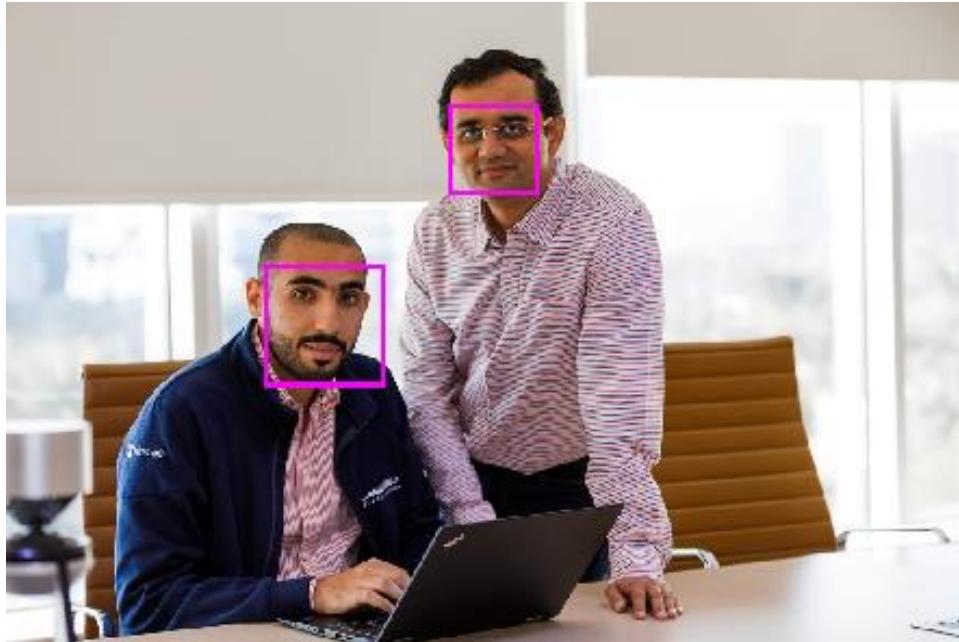
Preview JSON

You must be the change you
wish to see in the world!
Everything has its beauty , but
not everyone sees it !

Facial Detection, Recognition and Analysis

Facial Detection

Face detection involves identifying regions of an image that contain a human face, typically by returning bounding box coordinates that form a rectangle around the face, like this:



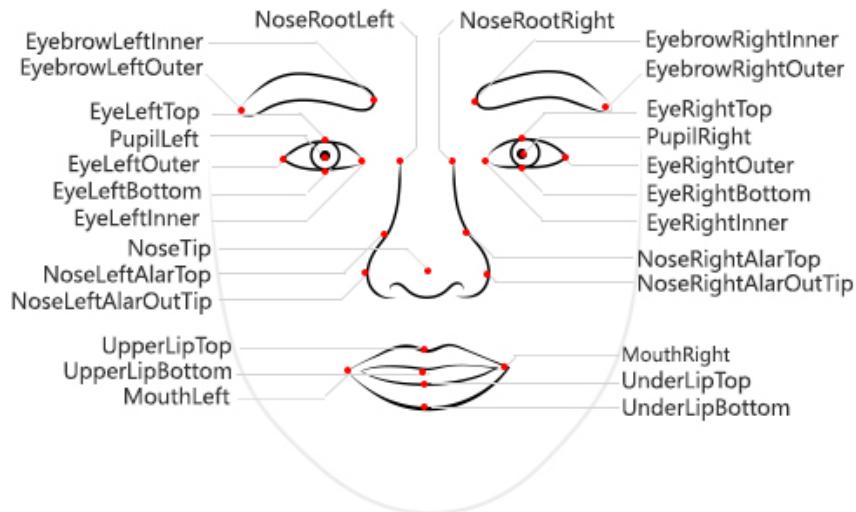
Facial Recognition

- A further application of facial analysis is to train a machine learning model to identify known individuals from their facial features.
- This usage is more generally known as facial recognition, and involves using multiple images of each person you want to recognize to train a model so that it can detect those individuals in new images on which it wasn't trained.



Facial Analysis

- Some algorithms can also return other information, such as facial landmarks (nose, eyes, eyebrows, lips, and others).
- These facial landmarks can be used as features with which to train a machine learning model from which you can infer information about a person, such as their perceived age or perceived emotional state.



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Uses of face detection and analysis

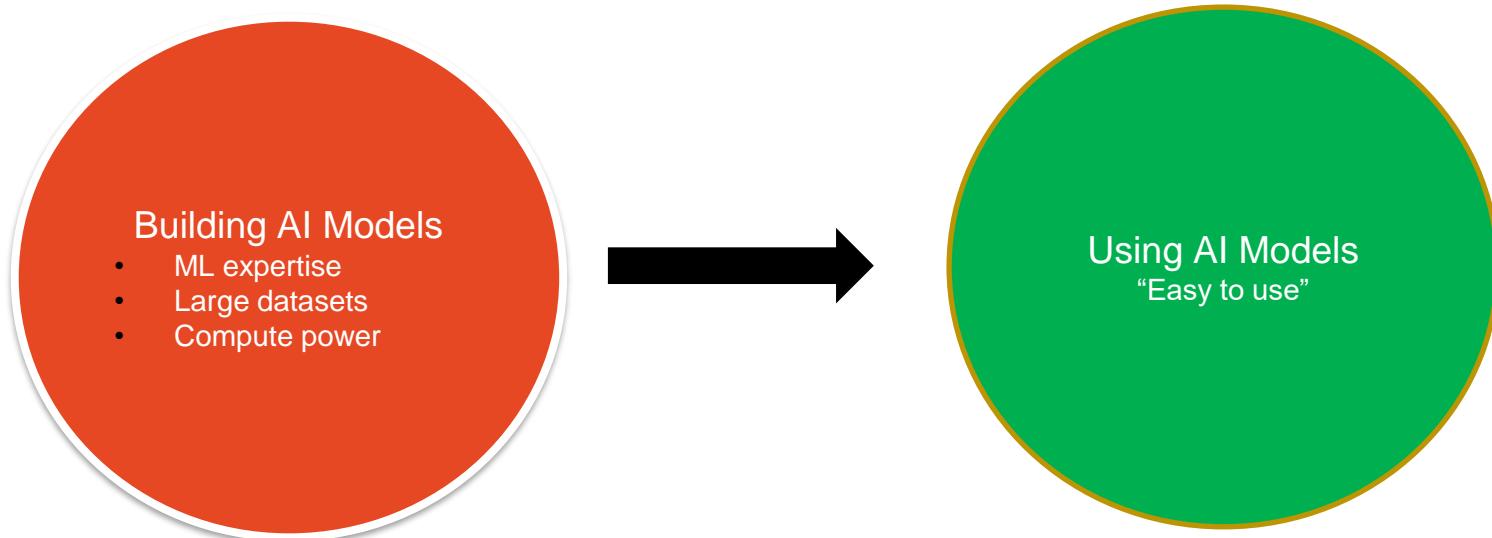
- **Security** – facial recognition can be used in building security applications, and increasingly it is used in smart phones operating systems for unlocking devices.
- **Social media** - facial recognition can be used to automatically tag known friends in photographs.
- **Intelligent monitoring** - for example, an automobile might include a system that monitors the driver's face to determine if the driver is looking at the road, looking at a mobile device, or shows signs of tiredness.
- **Advertising** - analyzing faces in an image can help direct advertisements to an appropriate demographic audience.
- **Missing persons** - using public cameras systems, facial recognition can be used to identify if a missing person is in the image frame.

Questions – True/False?

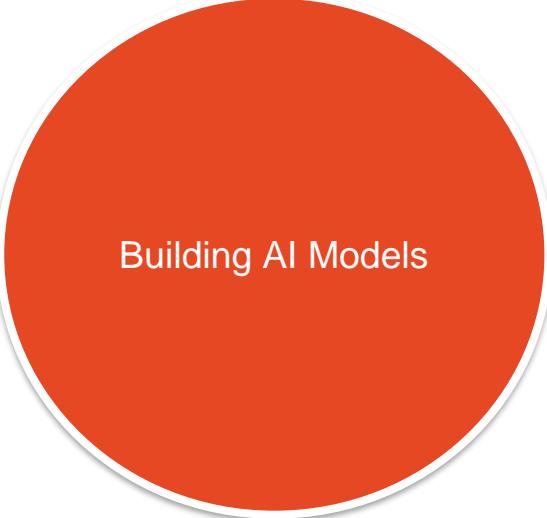
1. Facial detection can determine whether a person is wearing glasses.
2. Facial detection requires a full-frontal image.

Azure Cognitive Services

AI Models - Hard to Build, easy to use



Building - Hard to Build



Building AI Models

- **Domain Experts** for feature selection and dataset preparation
- **Data Scientist** to choose ML architecture, train and tune models
- **Compute Resources** are expensive but key in real-world ML

Using - Easy to use

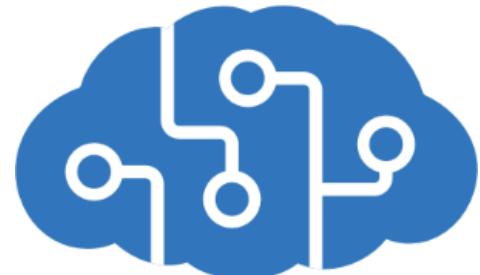
Using AI Models

- Domain experts and ML experts have done the hard work
- Users need little/no ML expertise
- Computational horse power not needed – pre trained models

What is Azure Cognitive Services

Microsoft Cognitive Services offers pre-built ML models for the most common uses cases.

- Pre-build AI algorithms
- Easy to consume
- Platform-agnostic HTTP APIs



Computer Vision service

What is Computer Vision Service

Azure's Computer Vision service gives you access to advanced algorithms that process images and return information based on the visual features you're interested in.

- Tag visual features
 - Describe an image
 - Detect faces
 - Detect image types
 - Detect domain-specific content
- Detect objects
- Detect brands
- Categorize an image
- Detect the color scheme
- Generate a thumbnail
- Get the area of interest
- Moderate content in images
- Optical Character Recognition (OCR)

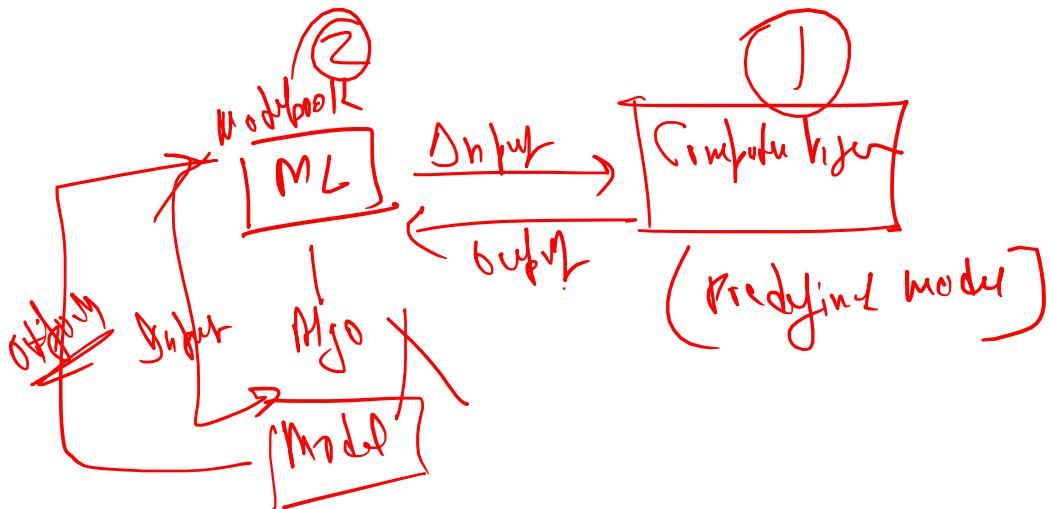
Questions: Computer Vision

True/False

- The Computer Vision service can moderate adult content - true
- The Computer Vision service can extract printed or handwritten text from images – true
- The Computer Vision service can translate text in an image - false
- Identify Landmark in an image - true
- identify dominant colors in online images to check if they influence the popularity of the featured product. - true

Demo: Computer Vision service

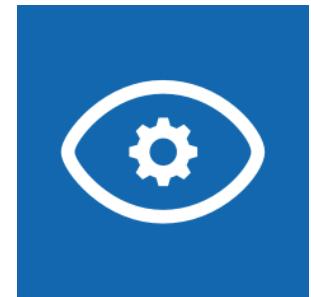
Demo: Computer Vision



Custom Vision service

What is Custom Vision Service

- This service lets you build and deploy your own image identifiers
- Computer vision service: Service provided, general purpose model
- Custom vision service: User provided, custom, domain specific model
- You will upload images, tag them and train model based on uploaded images
- Support two project types – Classification and Object detection
- Creates two resources: Training and Prediction



Question: Custom Vision Service

Question: You need to build a butterfly image classifier using your own set of images and labels. Which Azure cognitive service should you use?

- A. Video Indexer
- B. Custom Vision
- C. Computer Vision
- D. Bing Image Search



Question: Which two project types can you choose in the Custom Vision service?

- A. Semantic segmentation
- B. Facial Recognition
- C. Object Detection
- D. Classification
- E. K-Means Clustering

Demo: Custom Vision service

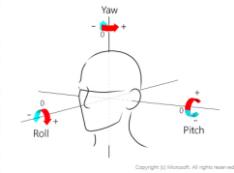
Face service

What is Face Service

- Azure Face cognitive services can be used to locate and analyze human faces in images or video content.
- Computer Vision can detect human faces and predict their age and gender.
- Face service can be used for a more detailed analysis: identify head pose, estimate gender, age and emotion, detect presence of facial hair or glasses, and even evaluate whether two faces belong to the same person.
- Video Indexer can be used to detect and identify faces in a video
- Azure Face service has a limitation on the size of input images. The image shouldn't be larger than 6 MB in any of the following formats: JPEG, PNG, GIF, and BMP.
- Two types of Operations
 - Face Detection
 - Face Recognition: Verify, Find similar, group and Identify people

Face Service - Face Detection

- **Face detection** is the action of locating human faces in an image and optionally returning different kinds of face-related data.
- **Attributes**
 - **Accessories**. Whether the given face has accessories. This attribute returns possible accessories including headwear, glasses, and mask, with confidence score between zero and one for each accessory.
 - **Age**. The estimated age in years of a particular face.
 - **Blur**. The blurriness of the face in the image. This attribute returns a value between zero and one and an informal rating of low, medium, or high.
 - **Emotion**. A list of emotions with their detection confidence for the given face. Confidence scores are normalized, and the scores across all emotions add up to one. The emotions returned are happiness, sadness, neutral, anger, contempt, disgust, surprise, and fear.
 - **Exposure**. The exposure of the face in the image. This attribute returns a value between zero and one and an informal rating of underExposure, goodExposure, or overExposure.
 - **Facial hair**. The estimated facial hair presence and the length for the given face.
 - **Gender**. The estimated gender of the given face. Possible values are male, female, and genderless.
 - **Glasses**. Whether the given face has eyeglasses. Possible values are NoGlasses, ReadingGlasses, Sunglasses, and Swimming Goggles.
 - **Hair**. The hair type of the face. This attribute shows whether the hair is visible, whether baldness is detected, and what hair colors are detected.
 - **Head pose**. The face's orientation in 3D space. This attribute is described by the pitch, roll, and yaw angles in degrees. The value ranges are -90 degrees to 90 degrees, -90 degrees to 90 degrees, and -90 degrees to 90 degrees, respectively. See the following diagram for angle mappings:
 - **Makeup**. Whether the face has makeup. This attribute returns a Boolean value for eyeMakeup and lipMakeup.
 - **Mask**. Whether the face is wearing a mask. This attribute returns a possible mask type, and a Boolean value to indicate whether nose and mouth are covered.
 - **Noise**. The visual noise detected in the face image. This attribute returns a value between zero and one and an informal rating of low, medium, or high.
 - **Occlusion**. Whether there are objects blocking parts of the face. This attribute returns a Boolean value for eyeOccluded, foreheadOccluded, and mouthOccluded.
 - **Smile**. The smile expression of the given face. This value is between zero for no smile and one for a clear smile.



Face Service - Face Recognition

Face recognition describes the work of comparing two different faces to determine if they're similar or belong to the same person..

- The Verify operation takes a face and determines if it belongs to the same person as another face. Addresses the question, "Are these two images the same person?"
- The Find Similar operation takes a face you have detected and extracts faces that look alike from a list of faces that you provide. Find Similar returns a subset of the faces in the list. This operation is useful for doing a face search by image.
- The Group operation creates several smaller groups from a list of faces based on the similarities of the faces. Also supports differentiating by another factor such as expression
- The Identify operation takes one or more face(s) and matches them to people. The Identify operation returns a list of possible matches with a confidence score between 0 and 1, with 1 being the most confident. Answers the question, "Can this detected face be matched to any enrolled face in a database?"

Question: Face Service

Question: Find the right operation for below requirement.

- A. Evaluate whether two faces belong to the same person
- B. Extract faces that look alike from a list of faces
- C. Divide a set of faces based on similarities

Question: Which two Azure cognitive services can be used to analyze faces within an image? Allows you to specify the labels for an image?

- A. Form Recognizer
- B. Computer Vision
- C. Personalizer
- D. Face
- E. Text Analytics

Question: Face Service

Question: Please select all Azure Cognitive Face service functions.

- A. Face Detection
- B. Objects Detection
- C. Find similar faces
- D. Person Identification
- E. Brand Identification
- F. Face Verification
- G. Image Analysis

Question: You need to identify a person using 8 MB image files in PNG format. Can you use the Person Identification function of Azure Face service for this purpose?

- A. Yes
- B. No

Question: Face Service

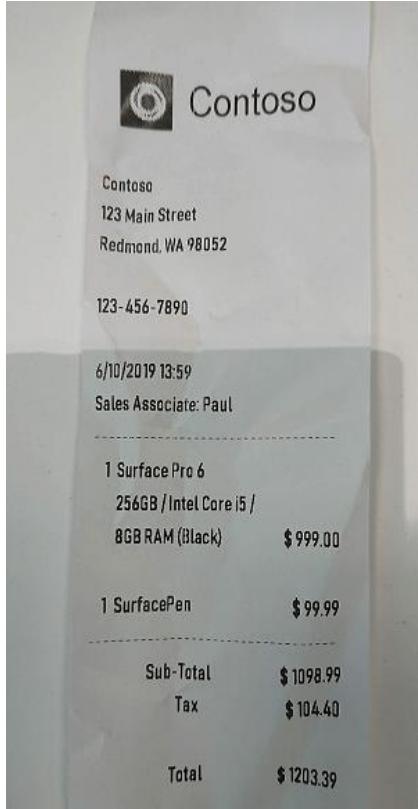
Question: Please select all face emotion attributes that Azure Cognitive Face service provides information for.

- A. hate
- B. fear
- C. smile
- D. contempt
- E. sparkle
- F. surprise
- G. neutral

Correct Answers: B, D, F, and G.

Form Recognizer

Why we need Form Recognizer Service



- We can use optical character recognition (OCR) technologies to extract the text contents from the digitized documents.
- But what after that? We still needs to review the extracted text to make sense of the information it contains.
- Form recognizer = Read text (OCR) + Interpret the information the contain

What is Form Recognizer

- Form recognizer service can be used to automate the processing of data in documents such as forms, invoices, and receipts.

Form Recognizer features

- Layout API - Extract text, selection marks, and tables structures, along with their bounding box coordinates, from documents.
- Custom models - 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.
- Prebuilt models - Extract data from unique document types using prebuilt models. Currently available are the following prebuilt models
 - Invoices
 - Sales receipts
 - Business cards
 - Identification (ID) cards
- Prebuilt model available only in English
- Custom model can be trained in Spanish, Chinese, Dutch, French, German, Italian and Portuguese
- Images must be JPEG, PNG, BMP, PDF, or TIFF formats
- File size must be less than 50 MB

Form Recognizer- Layout API

INVOICE

DATE	INVOICE NO	ADATUM CORPORATION	
Oct 21, 2020	1726	234 France Ave WA 76328 www.adatum.com sales@adatum.com	
INVOICE TO Fabrikam, Inc. 345 North St NY 98052			
Customer Id: 5791			
SALESPERSON	PAYMENT TERMS	DUUE DATE	
Jacob Steffensen	Due on Receipt	Nov 21, 2020	
QUANTITY	DESCRIPTION	UNIT PRICE	LINE TOTAL
05	Pool filter cartridge	\$9.00	\$49.80
01	C Filter replacement	\$12.49	\$12.49
01	Chlorinating tablets	\$85.00	\$85.00

Subtotal: \$147.29
Sales Tax: \$2.96
Total: \$150.25

Adventure Works Cycles
Business Unit
Marketing and Business division
Customer Service
Tel: 45 35 12 55 – Fax: 45 85 16 15

00577710	15/ 09/ 20
Invoice nr.	Stopover
N F 845 089 98	AV DOLCE
	In
	15/ 12/ 18
	Out
	17/ 12/ 18
	Rate

CUSTOMER: 029 VALEO		SE:	3	NB	E/ S:	1	Amount
Realization	Unit	Quantity					
TAX I.S.P.S.		1					10000.00
Ship monitoring	TJ	18358					0.119
Entry	TJ	18358					0.173
Stay tax	TJ	18358					0.135
LighHouse	TJ	18358					25021.00
Exit	TJ	18358					0.173
Stay tax	TJ	18358					0.135
LighHouse	TJ	18358					0.033

N-UM 644889, 00
TOTAL
N-UM 103184, 00
N-UM 748072, 00
VAT
TOTAL VAT Incl

Invoice amount is the following:
Seven hundred forty eight thousand seventy two CFA

Responsible Service head Director

Note: every reclamation should be sent within 15 days

STOCKHOLDERS' EQUITY STATEMENTS

(in millions) (Unaudited)	PART I		Three Months Ended March 31,		Nine Months Ended March 31,	
	2020	2019	2020	2019	2020	2019
Common stock and paid-in capital						
Balance, beginning of period	\$ 79,625	\$ 77,556	\$ 78,520	\$ 71,223		
Common stock issued	342	274	1,003	6,521		
Common stock repurchased	(1,492)	(1,216)	(3,649)	(3,433)		
Stock-based compensation expense	1,338	1,172	3,940	3,462		
Other, net	0	7	(1)	18		
Balance, end of period	79,813	77,791	79,813	77,791		
Retained earnings						
Balance, beginning of period	\$ 30,759	\$ 16,855	\$ 24,160	\$ 13,682		
Net income	10,752	8,809	33,079	26,053		
Common stock cash dividends	(3,865)	(3,518)	(11,627)	(10,592)		
Common stock repurchased	(5,614)	(3,538)	(13,590)	(11,482)		
Cumulative effect of accounting changes	0	0	0	677		
Balance, end of period	32,012	18,338	32,012	18,338		
Accumulated other comprehensive income (loss)						
Balance, beginning of period	(255)	(2,013)	(340)	(2,187)		
Other comprehensive income	2,931	748	3,016	989		
Cumulative effect of accounting changes	0	0	0	(67)		
Balance, end of period	2,676	(1,265)	2,676	(1,265)		
Total stockholders' equity	\$ 114,501	\$ 94,864	\$ 114,501	\$ 94,864		
Cash dividends declared per common share	\$ 0.51	\$ 0.46	\$ 1.53	\$ 1.38		

Refer to accompanying notes.

Form Recognizer- Layout API

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20548

FORM 10-Q

QUARTERLY REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the Quarterly Period Ended March 31, 2020

OR

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the Transition Period From _____ to _____
Commission File Number 001-37845

MICROSOFT CORPORATION

WASHINGTON
(STATE OF INCORPORATION)
91-1144442
ONE MICROSOFT WAY, REDMOND, WASHINGTON 98052-6399
(425) 927-8000
www.microsoft.com/investor

Securities registered pursuant to Section 12(b) of the Act:

Name of each class	Trading Symbol	Name of exchange or market on which registered
Common stock; \$0.00000625 par value per share	MSFT	NASDAQ
2.125% Notes due 2021	MSFT	NASDAQ
3.125% Notes due 2028	MSFT	NASDAQ
2.625% Notes due 2033	MSFT	NASDAQ

Securities registered pursuant to Section 12(g) of the Act:

None

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data file required to be submitted pursuant to Rule 405 of Regulation S-T (17 CFR 232.405) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes No

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer
Accelerated filer
Non-accelerated filer
Smaller reporting company
Emerging growth company

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act.

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes No

Indicate the number of shares outstanding of each of the issuer's classes of common stock as of the latest practicable date.

Class	Outstanding as of April 24, 2020
Common Stock \$0.00000625 par value per share	7,583,440,247 shares

Text, Tables,
Selection
Marks and
structure
extraction

```
{
  "status": "succeeded",
  "createdDateTime": "2020-11-17T18:48:48Z",
  "lastUpdatedDateTime": "2020-11-17T18:48:53Z",
  "analyzeResult": {
    "version": "2.1.0",
    "readResults": [
      ...
    ],
    "pageResults": [
      {
        "page": 1,
        "tables": [
          ...
        ],
        ...
      }
    ]
  }
}
```

```
{
  "status": "succeeded",
  "createdDateTime": "2020-11-17T18:48:48Z",
  "lastUpdatedDateTime": "2020-11-17T18:48:53Z",
  "analyzeResult": {
    "version": "2.1.0",
    "readResults": [
      ...
    ],
    "pageResults": [
      {
        "page": 1,
        "tables": [
          {
            "rows": 5,
            "columns": 3,
            "cells": [
              ...
            ],
            "elements": [
              "#/readResults/0/lines/24/words/0",
              "#/readResults/0/lines/24/words/1",
              "#/readResults/0/lines/24/words/2",
              "#/readResults/0/lines/24/words/3"
            ]
          }
        ],
        ...
      }
    ]
  }
}
```

Prebuilt Invoice model

CONTOSO LTD.

INVOICE

Contoso Headquarters
123 456th St
New York, NY, 10001

Microsoft Corp
123 Other St,
Redmond WA, 98052

BILL TO:
Microsoft Finance
123 Bill St,
Redmond WA, 98052

SHIP TO:
Microsoft Delivery
123 Ship St,
Redmond WA, 98052

SERVICE ADDRESS:
Microsoft Services
123 Service St,
Redmond WA, 98052

SALESPERSON	P.O. NUMBER	REQUISITIONER	SHIPPED VIA	F.O.B. POINT	TERMS
	PO-3333				

DATE	ITEM CODE	DESCRIPTION	QTY	U/M	PRICE	TAX	AMOUNT
3/4/2021	A123	Consulting Services	6	hours	\$30.00	10%	\$60.00
3/5/2021	B456	Document Fed	8		\$10.00	5%	\$80.00
3/6/2021	C789	Printing Fee	10	pages	\$1.00	20%	\$10.00

THANK YOU FOR YOUR BUSINESS!

REMIT TO:
Contoso-Billing
123 Remit St
New York, NY, 10001

INVOICE: INV-100
INVOICE DATE: 11/15/2019
DUUE DATE: 12/15/2019
CUSTOMER NAME: MICROSOFT CORPORATION
SERVICE PERIOD: 10/14/2019 - 11/14/2019
CUSTOMER ID: CID-12345

SUBTOTAL: \$100.00
SALES TAX: \$10.00
TOTAL: \$110.00
PREVIOUS UNPAID BALANCE: \$500.00
AMOUNT DUE: \$610.00

},
"InvoiceId": {
"type": "string",
"valueString": "INV-100",
"text": "INV-100",
"boundingBox": [
7.4926,
1.4203,
7.9938,
1.4203,
7.9938,
1.5198,
7.4926,
1.5198
],
"page": 1,
"confidence": 0.999,
"elements": [
"#/readResults/0/lines/3/words/1"

142

Prebuilt Receipt model

Prebuilt Receipt



Receipt information		JSON
<i>The prebuilt Receipt model provides both raw and normalized values. Below you can see the raw values on the left, and the normalized values on the right.</i>		
Merchant	Starbucks Reserve Roastery	Starbucks Reserve Roastery
Address	1124 Pike St Seattle, WA	1124 Pike St Seattle, WA
Phone number	206-624-0173	+12066240173
Date	05/17/2015	2015-05-17
Time	09:06 AM	09:06:00
Items	Cup Fund Donation	5.00
Subtotal	\$5.00	5
Total	\$5.00	5
Change Due	\$0.00	
<i>----- Check Closed ----- 05/17/2015 09:06 AM</i>		
<i>Starbucks Reserve Roastery & Tasting Room. Our rarest coffees, small-batch roasted in Seattle. www.Starbucks.com/Roastery Follow us on Twitter @SbxRoastery</i>		
<small>©StarbucksMelody.com</small>		

```
"valueArray": [
{
  "type": "object",
  "valueObject": {
    "Name": {
      "type": "string",
      "valueString": "Cup Fund Donation",
      "text": "Cup Fund Donation",
      "boundingBox": [
        201.7,
        335.7,
        470.7,
        342,
        470,
        373,
        201,
        366.7
      ],
      "page": 1,
      "confidence": 0.917
    },
    "TotalPrice": {
      "type": "number",
      "valueNumber": 5,
      "text": "5.00",
      "boundingBox": [
        637,
        339,
        701,
        336,
        702.3,
        363,
        638.3,
        366
      ],
      "page": 1,
      "confidence": 0.916
    }
  }
}]
```

Prebuilt Receipt model

The receipt is from Contoso and shows the following details:

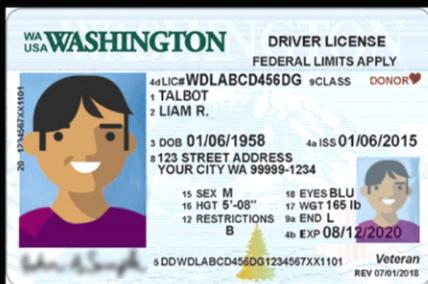
- Merchant Name: Contoso
- Merchant Address: 123 Main Street Redmond, WA 98052
- Merchant Phone Number: 987-654-3210
- Transaction Date: 6/10/2019
- Transaction Time: 13:59
- Subtotal: \$1098.99
- Tax: \$104.40
- Total: \$1203.39
- Items:
 - 1 Surface Pro 6 \$999.00
 - 1 SurfacePen \$99.99

Page # / Field name / Value	Confidence %
1 MerchantName	53.3%
Contoso	
1 MerchantAddress	99.0%
123 Main Street Redmond, WA 98052	
1 MerchantPhoneNumber	99.0%
text: 987-654-3210	
valuePhoneNumber: +19876543210	
1 TransactionDate	99.0%
text: 6/10/2019	
valueDate: 2019-06-10	
1 TransactionTime	98.8%
text: 13:59	
valueTime: 13:59:00	
1 Subtotal	98.8%
text: \$1098.99	
valueNumber: 1098.99	
1 Tax	95.7%
text: \$104.40	
valueNumber: 104.4	
1 Total	69.1%
text: \$1203.39	
valueNumber: 1203.39	
1 Item 1	78.4%
Surface Pro 6	
1 Item 1: Quantity	97.5%
1	
1 Item 1: TotalPrice	85.9%
text: \$999.00	

```
"Tax": {  
    "type": "number",  
    "valueNumber": 104.4,  
    "text": "$104.40",  
    "boundingBox": [  
        724,  
        1089,  
        889,  
        1103,  
        885,  
        1151,  
        717,  
        1137  
    ],  
    "page": 1,  
    "confidence": 0.957,  
    "elements": [  
        "#/readResults/0/lines/12/words/0"  
    ]  
},  
"Total": {  
    "type": "number",  
    "valueNumber": 1203.39,  
    "text": "$1203.39",  
    "boundingBox": [  
        711,  
        1205,  
        895,  
        1241,  
        888,  
        1282,  
        702,  
        1246  
    ],  
    "page": 1,  
    "confidence": 0.691,  
},
```

Prebuilt Identification (ID) cards model

Prebuilt Identification (ID) Cards

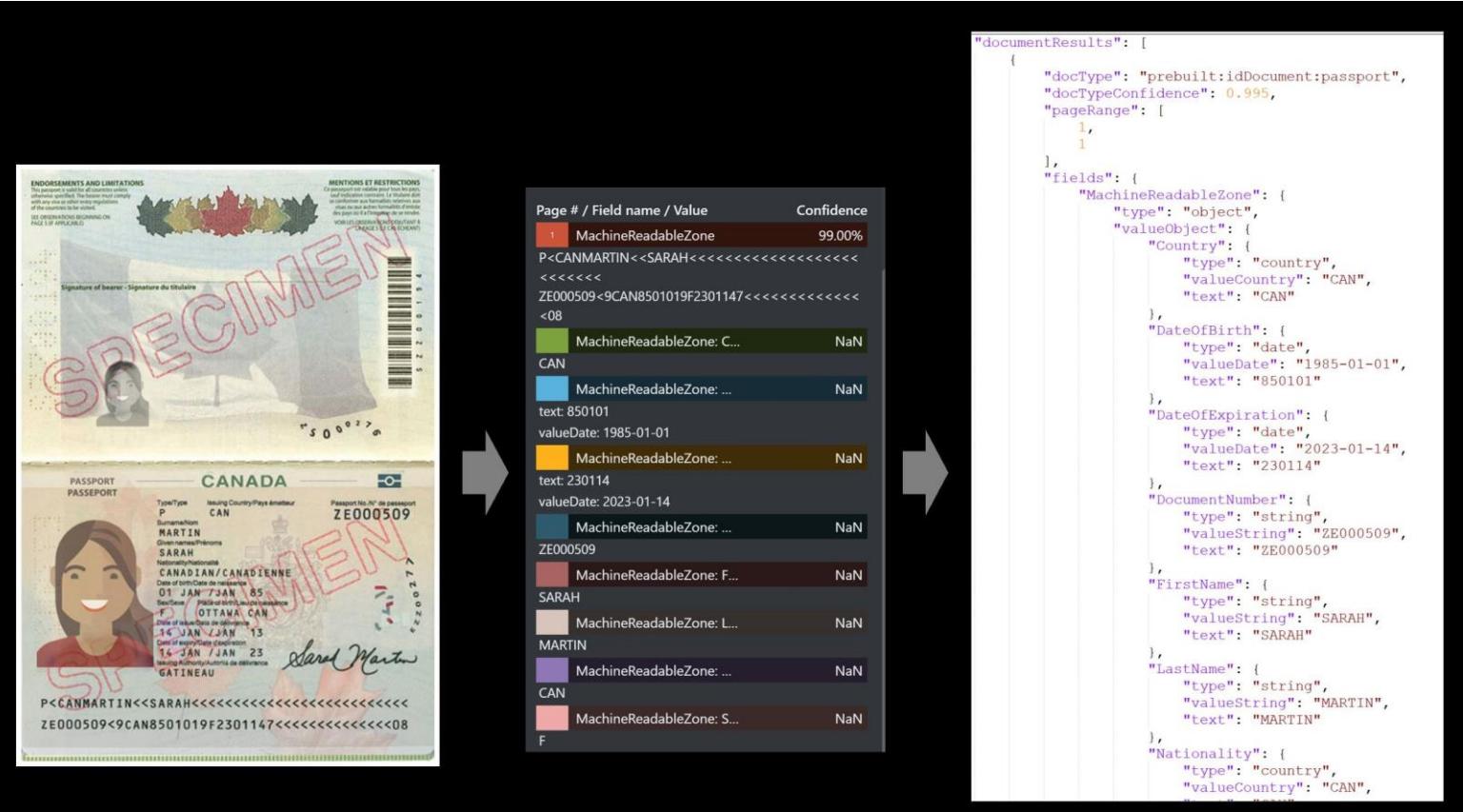


Page # / Field name / Value	Confidence
1 DocumentNumber	98.80%
text: LIC#WDLABCD456DG	
valueString: LICWDLACD5DG	
1 LastName	97.90%
TALBOT	
1 FirstName	96.30%
LIAM R.	
1 DateOfBirth	99.00%
text: 01/06/1958	
valueDate: 1958-01-06	
1 DateOfExpiration	99.00%
text: 08/12/2020	
valueDate: 2020-08-12	
1 Sex	99.30%
M	
1 Address	94.90%
123 STREET ADDRESS YOUR CITY WA 99999-1234	
1 Country	99.50%
United States	
1 Region	99.00%
Washington	



```
"documentResults": [
  {
    "docType": "prebuilt:idDocument:driverLicense",
    "docTypeConfidence": 0.995,
    "pageRange": [
      1,
      1
    ],
    "fields": {
      "DocumentNumber": {
        "type": "string",
        "valueString": "LICWDLACD5DG",
        "text": "LIC#WDLABCD456DG",
        "boundingBox": [
          160,
          70,
          313,
          69,
          313,
          84,
          161,
          85
        ],
        "page": 1,
        "confidence": 0.988,
        "elements": [
          "#/readResults/0/lines/4/words/1"
        ]
      },
      "LastName": {
        "type": "string",
        "valueString": "TALBOT",
        "text": "TALBOT",
        "boundingBox": [
          160,
          86,
          213,
          85,
          213,
          99,
          160,
          100
        ],
        "page": 1,
        "confidence": 0.979,
        "elements": [
          "#/readResults/0/lines/6/words/1"
        ]
      },
      "FirstName": {
        "type": "string",
        "valueString": "LIAM R."
      }
    }
  }
]
```

Prebuilt Identification (ID) cards model



Prebuilt Business Cards model

Prebuilt Business Cards



Page # / Field name / Value	Confidence %
1 CompanyNames CONTOSO	76.8%
1 ContactNames Chris Smith	99.0%
1 JobTitles Senior Researcher	99.0%
1 Departments Cloud & AI Department	98.6%
1 Emails chris.smith@contoso.com	99.0%
1 Websites https://www.contoso.com/	99.5%
1 MobilePhones +1 (987) 123-4567	99.5%
1 OtherPhones +1 (987) 213-5674	98.8%
1 Faxes +1 (987) 312-6745	98.9%
1 Addresses 4001 1st Ave NE Redmond, WA 98052	98.7%

```
{
  "documentResults": [
    {
      "docType": "prebuilt:businesscard",
      "pageRange": [
        1,
        1
      ],
      "fields": {
        "CompanyNames": {
          "type": "array",
          "valueArray": [
            {
              "type": "string",
              "valueString": "CONTOSO",
              "text": "CONTOSO",
              "boundingBox": [
                535,
                1571,
                1331,
                1571,
                1332,
                1722,
                534,
                1719
              ],
              "page": 1,
              "confidence": 0.768
            }
          ]
        },
        "ContactNames": {
          "type": "array",
          "valueArray": [
            {
              "type": "object",
              "valueObject": {
                "FirstName": {
                  "type": "string",
                  "valueString": "Chris",
                  "text": "Chris",
                  "boundingBox": [
                    1556,
                    2018,
                    1920,
                    2021,
                    1919,
                    2156,
                    1558,
                    2154
                  ],
                  "page": 1
                }
              }
            }
          ]
        }
      }
    }
  ]
}
```

Question: Form Recognizer

Question: In which of the following scenarios can you use the Form Recognizer service? Choose 2 answers from the options given below

- Extract the invoice number from an invoice
- Translate a form from French to English
- Find image of product in a catalog
- Identity the retailer from a receipt

Statement – True/False

Prebuilt business card model can extract information from business cards in English.

Prebuilt receipt model can extract information from sales receipts in French.

Custom model can be trained to extract information from custom forms in Spanish.

Natural Language Processing (NLP)

Natural Language Processing (NLP) workloads :

- Natural language processing (NLP) is a branch of artificial intelligence that helps computers understand, interpret and manipulate human language.
- Features of common NLP Workload Scenarios
 - Identify features and uses for key phrase extraction
 - Identify features and uses for entity recognition
 - Identify features and uses for sentiment analysis
 - Identify features and uses for language modeling
 - Identify features and uses for speech recognition and synthesis
 - Identify features and uses for translation

Key Phrase Extraction vs
Entity recognition vs
Sentiment analysis

Key Phrase Extraction

- Key phrase extraction is the concept of evaluating the text of a document, or documents, and then identifying the main talking points of the document(s).

"We had dinner here for a birthday celebration and had a fantastic experience. We were greeted by a friendly hostess and taken to our table right away. The ambiance was relaxed, the food was amazing, and service was terrific. If you like great food and attentive service, you should try this place."

Extracted the following phrases:

- *attentive service*
- *great food*
- *birthday celebration*
- *fantastic experience*
- *friendly hostess*

- Key phrase extraction works better when you provide it with bigger amounts of text to work on.

Entity recognition

- Return a list of entities in the text that it recognizes.
- The service can also provide links to more information about that entity on the web.
- An entity is essentially an item of a particular type or a category; and in some cases, subtype, such as those as shown in the following table.

"I ate at the restaurant in Seattle last week."

Entity	Type	SubType	Wikipedia URL
Seattle	Location		✓ https://en.wikipedia.org/wiki/Seattle
last week	DateTime	DateRange	

Sentiment analysis

- Sentiment analysis can evaluate text and return sentiment scores and labels for each sentence.
- This capability is useful for detecting positive and negative sentiment in social media, customer reviews, discussion forums and more.
- The service evaluates the text and returns a sentiment score in the range of 0 to 1, with values closer to 1 being a positive sentiment.
- Sentiment analysis performs better on smaller amounts of text. Less words means less distractors for the sentiment analysis model, and for that reason, it produces a higher-quality results with smaller amounts of text.

- For example, the following two restaurant reviews could be analyzed for sentiment:

Review one: "We had dinner at this restaurant last night and the first thing I noticed was how courteous the staff was. We were greeted in a friendly manner and taken to our table right away. The table was clean, the chairs were comfortable, and the food was amazing."

Review Two: "Our dining experience at this restaurant was one of the worst I've ever had. The service was slow, and the food was awful. I'll never eat at this establishment again."

Questions

Question: For each of the following statements about Sentiment Analysis, select Yes if the statement is true. Otherwise, select No.

Statement	Yes	No
Sentiment Analysis returns sentiment labels and scores for the entire document.	<input type="radio"/>	<input type="radio"/>
Sentiment Analysis returns sentiment labels and scores for each sentence within a document.	<input type="radio"/>	<input type="radio"/>
Confidence scores range from -1 to 1.	<input type="radio"/>	<input type="radio"/>

Questions

Question: Which two of the following can be found in a text document by using entity recognition? Each correct answer presents a complete solution.

- A. Dates and times of a day
- B. Intent and actions
- C. Passport number
- D. Main talking points
- E. Emotion expressed

Question: Which requirement would require you to use sentiment analysis?

- A. Find the use of brand names in documents.
- B. Extract brand information from documents.
- C. Transcribe the recording of a marketing presentation into text.
- D. Analyze social media for a brand.

Questions

Select the correct option

Understand how upset a customer is based on the text contained in the support ticket -

Sentiment Analysis

Summarize important information from the support ticket - **Key Phrase Extraction**

Extract key dates from the support ticket - **Entity Recognition**

Understand how upset a customer is based on the text contained in the support ticket -

Language Detection

Summarize important information from the support ticket - **Key Phrase Extraction**

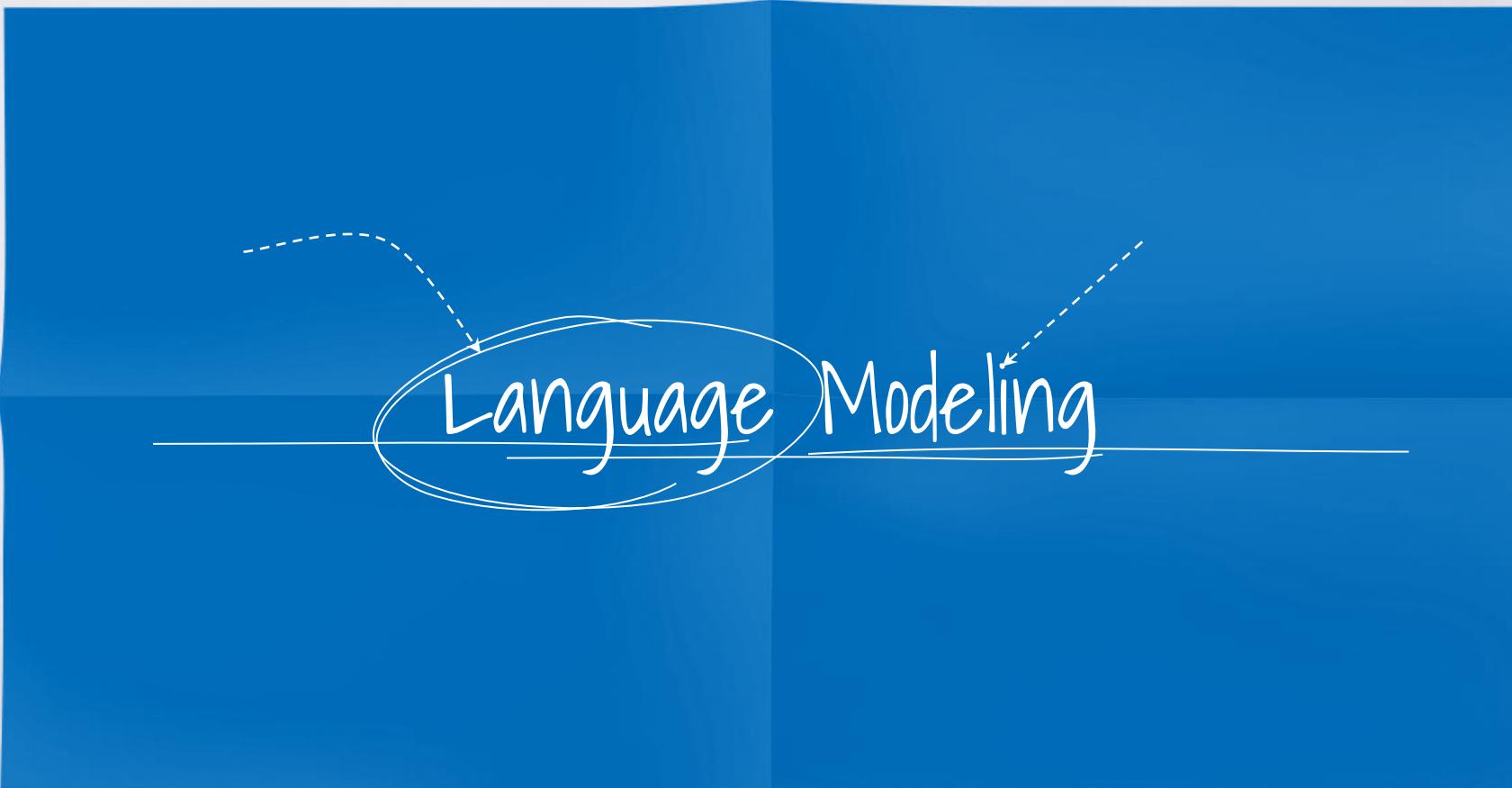
Extract key dates from the support ticket - **Entity Recognition**

Understand how upset a customer is based on the text contained in the support ticket -

Sentiment Analysis

Summarize important information from the support ticket - **Entity Recognition**

Extract key dates from the support ticket - **Key Phrase Extraction**



Language Modeling

Language Modeling

- Language understanding extracts the overall meaning from the text.
- The intent and actions expressed in a text are an example of language understanding.
- Common scenarios for this kind of solution include customer support applications, reservation systems, and home automation among others.
- Three core concepts: utterances, entities, and intents
- "Switch the fan on."
- "Turn on the light."

Statement
Language modeling can determine the emotion in a text statement.
Language modeling can discover the meaning in a text statement.
Language modeling can detect the language the text is written in.

Language Modeling

- Language understanding extracts the overall meaning from the text.
- The intent and actions expressed in a text are an example of language understanding.
- Common scenarios for this kind of solution include customer support applications, reservation systems, and home automation among others.
- Three core concepts: utterances, entities, and intents
- "Switch the fan on."
- "Turn on the light."

Statement	Yes	No
Language modeling can determine the emotion in a text statement.	<input type="radio"/>	<input checked="" type="radio"/>
Language modeling can discover the meaning in a text statement.	<input checked="" type="radio"/>	<input type="radio"/>
Language modeling can detect the language the text is written in.	<input type="radio"/>	<input checked="" type="radio"/>

Speech recognition and Synthesis

Speech recognition and Synthesis

- Speech recognition is the ability to detect and interpret spoken input and turn it into data so it can be processed as text.
- Use Cases:
 - Providing closed captions for recorded or live videos
 - Creating a transcript of a phone call or meeting
 - Automated note dictation
 - Determining intended user input for further processing
- Speech synthesis is the ability to generate spoken output by converting text into audio speech.
- Speech synthesis is available in multiple languages.
- It and can be customized to adjust pitch, add pauses, improve pronunciation, etc. by using speech synthesis markup language (SSML).
- It helps people with disabilities, like vision impairment
- Use Cases:
 - Generating spoken responses to user input.
 - Creating voice menus for telephone systems.
 - Reading email or text messages aloud in hands-free scenarios.
 - Broadcasting announcements in public locations, such as railway stations or airports.

Question: Speech recognition and Synthesis

You need to build an app that will read recipe instructions aloud to support users who have reduced vision.

Which service will you use?

Language Understanding

Text Analytics

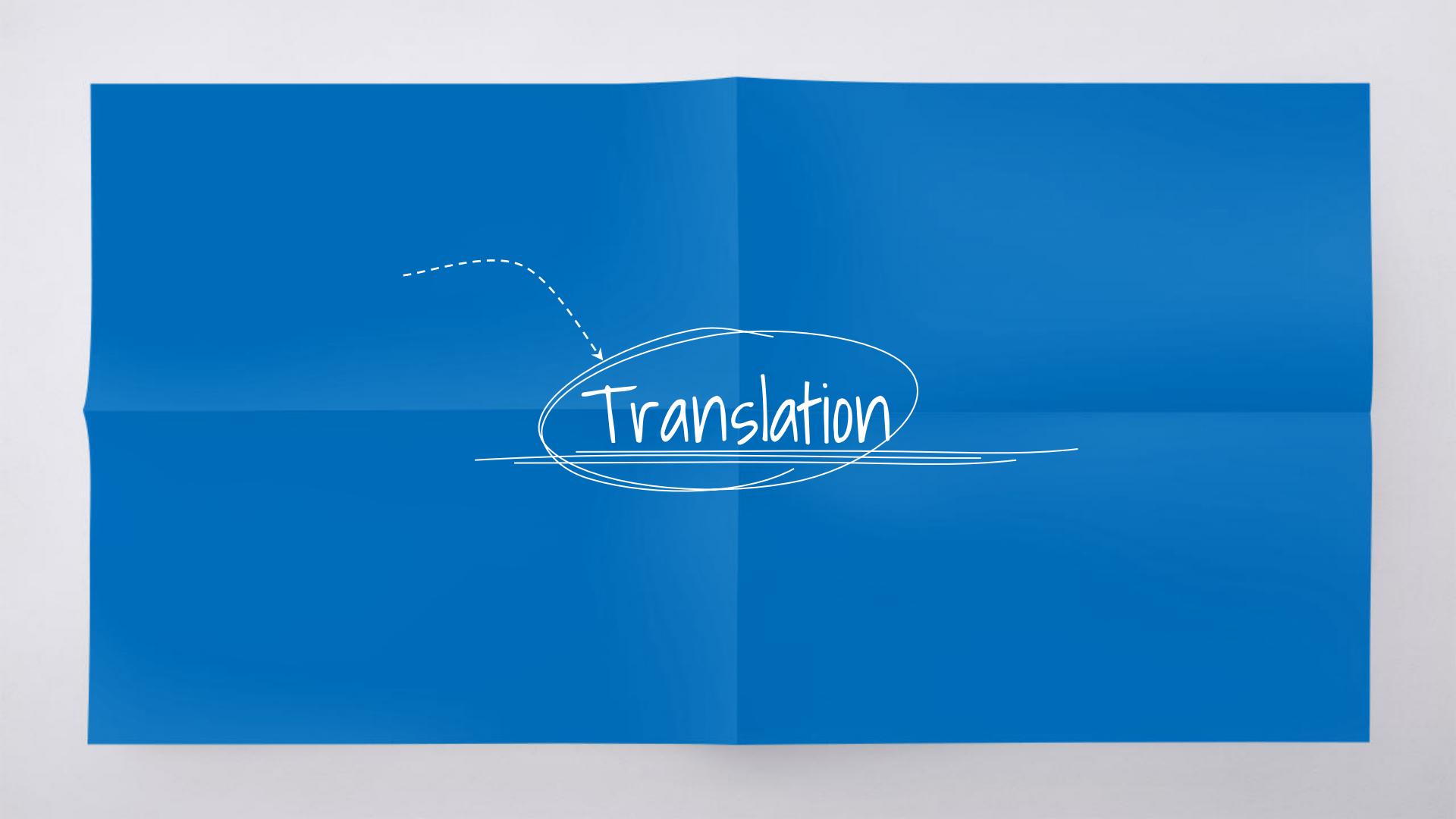
Speech

Translator Text

Question: Speech recognition and Synthesis

In which two scenarios can you use speech recognition?

- providing closed captions for recorded or live videos
- an in car system that reads text messages aloud
- creating an automated public address system for a train station
- creating a transcript of a telephone call or meeting



Translation

Translation

- Translation is the ability to translate either text or speech from one language to another.
- Why literal translation doesn't work?
 - There may not be an equivalent word in the target language.
 - Literal translation can change the meaning of the phrase or not get the context correct.
 - The French phrase "éteindre la lumière" can be translated to English as "turn off the light".
 - In French "fermer la lumiere" to mean the same thing but in English "close the light";
- Text and speech translation
 - Text translation can be used to translate documents from one language to another.
 - Translate email communications that come from foreign governments
 - Ability to translate web pages on the Internet.
 - Speech translation is used to translate between spoken languages, sometimes directly (speech-to-speech translation) and sometimes by translating to an intermediary text format (speech-to-text translation).

Azure tools and services for NLP



Azure Services for NLP

- Natural language processing (NLP) is a branch of artificial intelligence that helps computers understand, interpret and manipulate human language.
- Features of common NLP Workload Scenarios
 - Identify features and uses for **key phrase extraction**
 - Identify features and uses for **entity recognition**
 - Identify features and uses for **sentiment analysis**
 - Identify features and uses for **language modeling**
 - Identify features and uses for **speech recognition and synthesis**
 - Identify features and uses for **translation**

Text Analytics Service

LUIS (Language Understanding Service)

Speech Service

Translator Text Service



Text Analytics Service

Text Analytics Service

- The Text Analytics API is a cloud-based service that provides Natural Language Processing (NLP) features for text mining and text analysis.
- Text Analytics can be used with Power Apps to analyze text, and there is a Text Analytics connector that can be used to call Text Analytics from a canvas app.
- Support features:
 - **Language detection:** identify the language in which text is written. The service will return NaN when it cannot determine the language in the provided text.

Review 1: "A fantastic place for lunch. The soup was delicious."

Review 2: "Comida maravillosa y gran servicio."

Review 3: "The croque monsieur avec frites was terrific. Bon appetit!"

Document	Language Name	ISO 6391 Code	Score
Review 1	English	en	1.0
Review 2	Spanish	es	1.0
Review 3	English	en	0.9

- Key phrase extraction
- Named Entity Recognition
- Sentiment Analysis

Knowledge Check

1. You want to use the Text Analytics service to determine the key talking points in a text document. Which feature of the service should you use?

- Sentiment analysis
- Key phrase extraction
- Entity detection

2. You use the Text Analytics service to perform sentiment analysis on a document, and a score of 0.99 is returned. What does this score indicate about the document sentiment?

- The document is positive.
- The document is neutral.
- The document is negative.

3. When might you see NaN returned for a score in Language Detection?

- When the score calculated by the service is outside the range of 0 to 1
- When the predominant language in the text is mixed with other languages
- When the language is ambiguous

Knowledge Check

- Question: For each of the following statements about the Azure Cognitive Services Text Analytics service, select Yes if the statement is true. Otherwise, select No.

Statement
The results from the Key Phrases operation in Text Analytics includes a confidence score between 0 and 1.
The Text Analytics API can be used with C#.
Text Analytics can be used by Power App canvas apps to analyze text.

Knowledge Check

- Question: For each of the following statements about the Azure Cognitive Services Text Analytics service, select Yes if the statement is true. Otherwise, select No.

Statement	Yes	No
The results from the Key Phrases operation in Text Analytics includes a confidence score between 0 and 1.	<input type="radio"/>	<input checked="" type="radio"/>
The Text Analytics API can be used with C#.	<input checked="" type="radio"/>	<input type="radio"/>
Text Analytics can be used by Power App canvas apps to analyze text.	<input checked="" type="radio"/>	<input type="radio"/>



Speech Service

Speech recognition and Synthesis

- Speech recognition (Speech-to-text API) is the ability to detect and interpret spoken input and turn it into data so it can be processed as text.
- The model is optimized for two scenarios, conversational and dictation.
- It can be used for both Real-time transcription and Batch transcription
- You can create and train your custom model
- Use Cases:
 - Providing closed captions for recorded or live videos
 - Creating a transcript of a phone call or meeting
 - Automated note dictation
 - Determining intended user input for further processing
- Speech synthesis (Text-to-Speech API) is the ability to generate spoken output by converting text into audio speech.
- Speech synthesis is available in multiple languages.
- It can be customized to adjust pitch, add pauses, improve pronunciation, etc. by using speech synthesis markup language (SSML).
- It helps people with disabilities, like vision impairment
- Use Cases:
 - Generating spoken responses to user input.
 - Creating voice menus for telephone systems.
 - Reading email or text messages aloud in hands-free scenarios.
 - Broadcasting announcements in public locations, such as railway stations or airports.
- Speech Translation: enables speech-to-text and speech-to-speech translation.

Knowledge Check

1. You plan to build an application that uses the Speech service to transcribe audio recordings of phone calls into text, and then submits the transcribed text to the Text Analytics service to extract key phrases. You want to manage access and billing for the application services in a single Azure resource. Which type of Azure resource should you create?

- Speech
- Text Analytics
- Cognitive Services

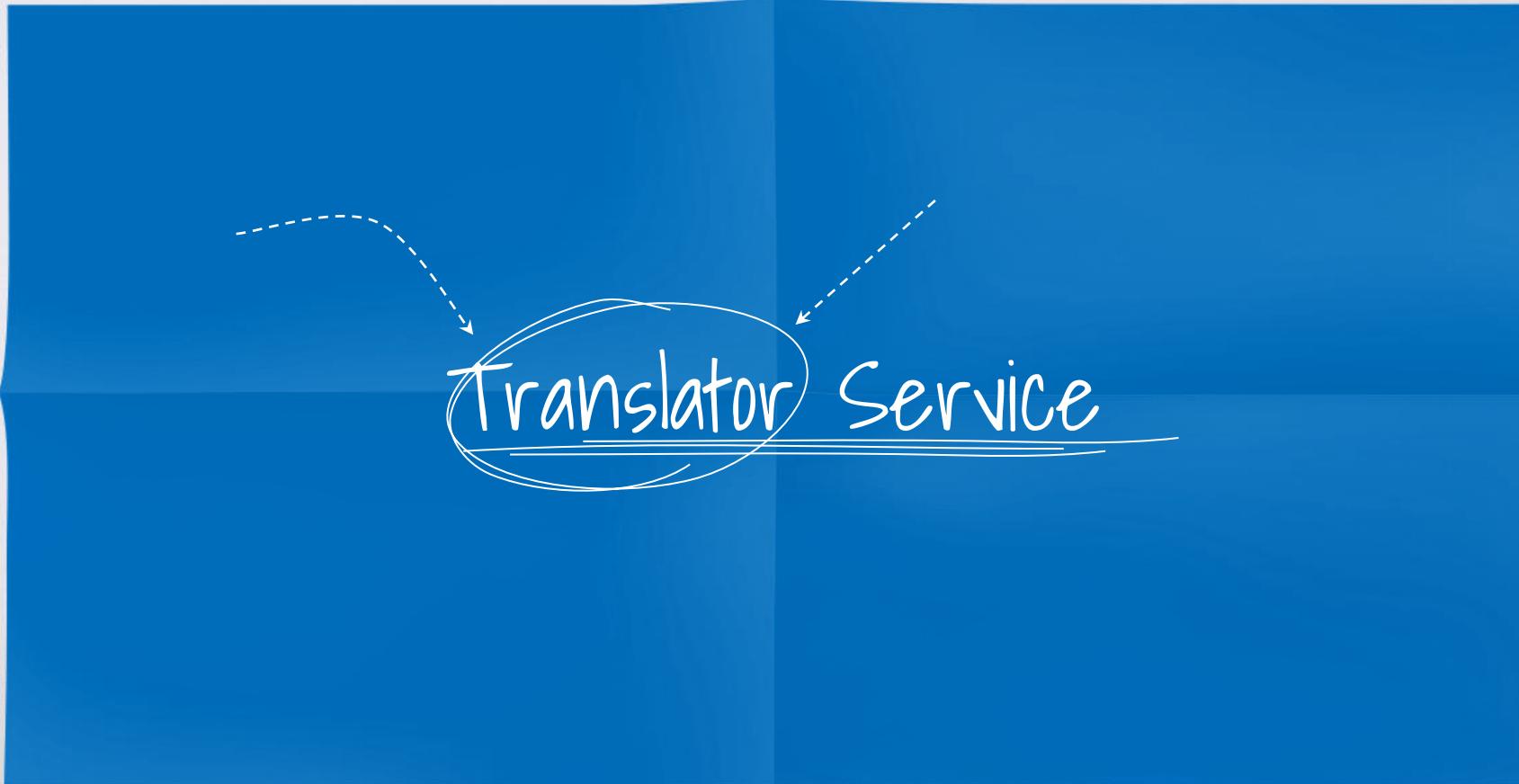
2. You want to use the Speech service to build an application that reads incoming email message subjects aloud. Which API should you use?

- Speech-to-Text
- Text-to-Speech
- Translate

Knowledge Check

- Question: For each of the following statements, select Yes if the statement is true. Otherwise, select No.

Statement
To use the Speech service, you need to build a custom speech model.
The Speech service can transcribe audio streams in real time.
The Speech service can transcribe audio files asynchronously.



Translator Service

A blue rectangular background with a white border. In the center, the words "Translator Service" are written in a white, hand-drawn style font. "Translator" is enclosed in a white oval. Two dashed white arrows point from the top left and top right towards the center of the oval, indicating the two parts of the phrase.

Translation Service

- The Translator service translates text from one language to another language in near real-time.
- The Translator service allows you to specify multiple languages, so you can simultaneously translate into multiple languages.
- The Translator service allows you to specify a cultural variant when translating into a language. You append the cultural code to the language code, for example, fr-CA for Canadian French.
- The Translator Text service, which supports text-to-text translation.
- The Speech service, which enables speech-to-text and speech-to-speech translation.
- The service uses a Neural Machine Translation (NMT) model for translation

Knowledge Check

1. You are developing an application that must take English input from a microphone and generate a real-time text-based transcription in Hindi. Which service should you use?

- Translator Text
- Speech
- Text Analytics

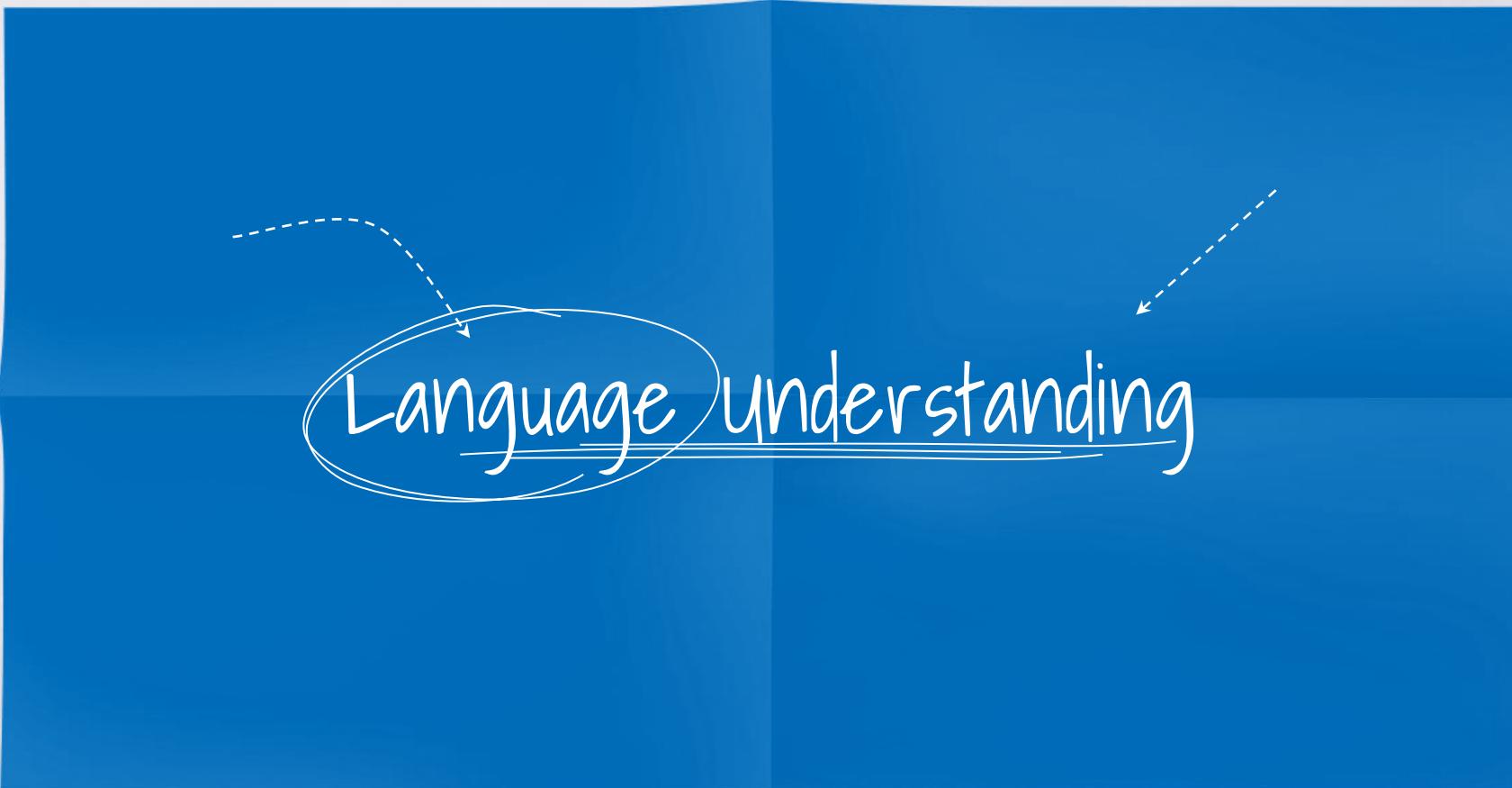
2. You need to use the Translator Text service to translate email messages from Spanish into both English and French? What is the most efficient way to accomplish this goal?

- Make a single call to the service; specifying a "from" language of "es", a "to" language of "en", and another "to" language of "fr".
- Make a single call to the service; specifying a "from" language of "es", and a "to" language of "en-fr".
- Make two calls to the service; one with a "from" language of "es" and a "to" language of "en", and another with a "from" language of "es" and a "to" language of "fr"

Knowledge Check

Question: For each of the following statements about the Translator service, select Yes if the statement is true. Otherwise, select No

Statement
The Translator service uses Statistical Machine Translation (SMT) technology.
The Translator service can simultaneously translate from one language into multiple other languages.
The Translator service supports translation into language variants such as French and Canadian French.



Language understanding

Language understanding

- Language understanding extracts the overall meaning from the text.
- The intent and actions expressed in a text are an example of language understanding.
- Common scenarios for this kind of solution include customer support applications, reservation systems, and home automation among others.
- Three core concepts: utterances, entities, and intents
- "Switch the fan on."
- "Turn on the light."
- To use the Language Understanding service, you need two kinds of resource:
- **An authoring resource:** used to define, train, and test the language model. This must be a Language Understanding - Authoring resource in your Azure subscription.
- **A prediction resource:** used to publish model and handle requests from client applications that use it. This can be either a Language Understanding or Cognitive Services resource in your Azure subscription.

Language understanding

Intent	Related Utterances	Entities
Greeting	"Hello"	
	"Hi"	
	"Hey"	
	"Good morning"	
TurnOn	"Switch the fan on"	fan (device)
	"Turn the light on"	light (device)
	"Turn on the light"	light (device)
TurnOff	"Switch the fan off"	fan (device)
	"Turn the light off"	light (device)
	"Turn off the light"	light (device)
CheckWeather	"What is the weather for today?"	today (datetime)
	"Give me the weather forecast"	
	"What is the forecast for Paris?"	Paris (location)
	"What will the weather be like in Seattle tomorrow?"	Seattle (location), tomorrow (datetime)
None	"What is the meaning of life?"	
	"Is this thing on?"	

Knowledge Check

1. You need to provision an Azure resource that will be used to author a new Language Understanding application. What kind of resource should you create?

- Text Analytics
- Language Understanding
- Cognitive Services

2. You are authoring a Language Understanding application to support an international clock. You want users to be able to ask for the current time in a specified city, for example "What is the time in London?". What should you do?

- Define a "city" entity and a "GetTime" intent with utterances that indicate the city intent.
- Create an intent for each city, each with an utterance that asks for the time in that city.
- Add the utterance "What time is it in city" to the "None" intent.

3. You have published your Language Understanding application. What information does a client application developer need to get predictions from it?

- The endpoint and key for the application's prediction resource
- The endpoint and key for the application's authoring resource
- The Azure credentials of the user who published the Language Understanding application

Knowledge Check

Question: Which two Azure cognitive services can you combine to recognize intents in voice commands? Each correct answer presents part of the solution.

Choose the correct answers

- A. Language Understanding
- B. Text Translator
- C. Speaker Recognition
- D. Form Recognizer
- E. Speech

Conversational AI (Use cases)

Conversational AI

Hi. I'm the Adatum support bot. How can I help you?

Adatum Support at 10:50 AM

I have a question about my bill

You

OK. What's your account number?

Adatum Support at 10:50 AM

123-45-678A

You

Alright. I've found your details.

Is your question about:

1. The bill amount
2. The due date
3. Something else

Enter 1, 2, or 3

Type your message here ...

- The capability of a AI model (also called “agent” or “Bot”) to participate in conversation.
- These Bots provide a first-line of automated support to the customers.
- Bots can be deployed over many channels, including email, social media platforms, and even voice calls.
- Use cases
 - Webchat Bots
 - Personal digital assistant
 - Telephone voice menus
- Azure service used for Conversational AI:
 - QnA Maker
 - Azure Bot Service

Webchat bot

- A chatbot can utilize knowledge bases to conduct a real-time conversation with humans using text, speech, and other available communication channels.
- Webchat bot is a specific type of chatbot that communicates via a web channel and is typically integrated with web-enabled applications.
- Example: A travel site to interact with online customers and help with the real-time booking of their trips.
- Example:

Personal digital assistant

- A personal digital assistant is a type of bot that has knowledge of a user's needs and preferences, and the ability to act on those needs and preferences.
- A personal digital assistant is able to schedule meetings and appointments on behalf of a user as it is able to view the calendar and respond with available time slots to emails containing a request for a meeting.
- Helps you being able to talk to your phone, your navigator, your car and ask a simple questions.
- Example: Scheduling meeting and appointments

Telephone voice menus

- Telephone voice menus use speech recognition and synthesis and can reduce the workload on human operators by providing generic instructions to customers, automatically transferring calls to the relevant teams, or managing the waiting queue, all of which helps to support business operations even during non-working hours and holidays.
- Example: Capturing feedback after an interaction with a call center

Knowledge Check

Question: Find the right conversational AI solution to a scenario

Scenario
An interactive component on a banking site that understands a client's requirements and provides general answers.
An intelligent application that checks your calendar to automatically accept e-meeting invitations.
An interactive response system that transfers calls to required employee numbers.

Question: An AI solution on your smartphone can understand your voice command and send text messages while you drive a car.

Which conversational AI is this an example of?

- Telephone voice menu
- Personal digital assistant
- Webchat bot

Knowledge Check

Question: Find the right conversational AI solution to a scenario

Scenario	Conversational AI Solution
An interactive component on a banking site that understands a client's requirements and provides general answers.	Webchat bot
An intelligent application that checks your calendar to automatically accept e-meeting invitations.	Personal digital assistant (PDA)
An interactive response system that transfers calls to required employee numbers.	Telephone voice menu

Question: An AI solution on your smartphone can understand your voice command and send text messages while you drive a car.

Which conversational AI is this an example of?

- Telephone voice menu
- Personal digital assistant
- Webchat bot



QnA Maker and Bot Service

QnA Maker Service

- ❑ QnA Maker service create a natural conversational layer over your knowledge base. It is used to find the most appropriate answer for any input from your custom knowledge base (KB) of information.
- ❑ Type of data that you can import – FAQ's, product manuals, spreadsheets or a web page.
- ❑ When to use QnA Maker? - When you have static information or when you want to provide the same answer to a request, question, or command
- ❑ The service provides a dedicated QnA Maker portal web-based interface that you can use to import, create, train, publish, and manage knowledge bases.

Resources created with QnA Maker Service

- ❑ **QnA Maker** is used for authoring and query prediction.
- ❑ It provides access to the authoring and publishing APIs of the QnA Maker service.
- ❑ It also uses natural language processing (NLP) capabilities to learn about specifics of questions in the knowledge base and predict at runtime which QnA pair matches as the best answer.

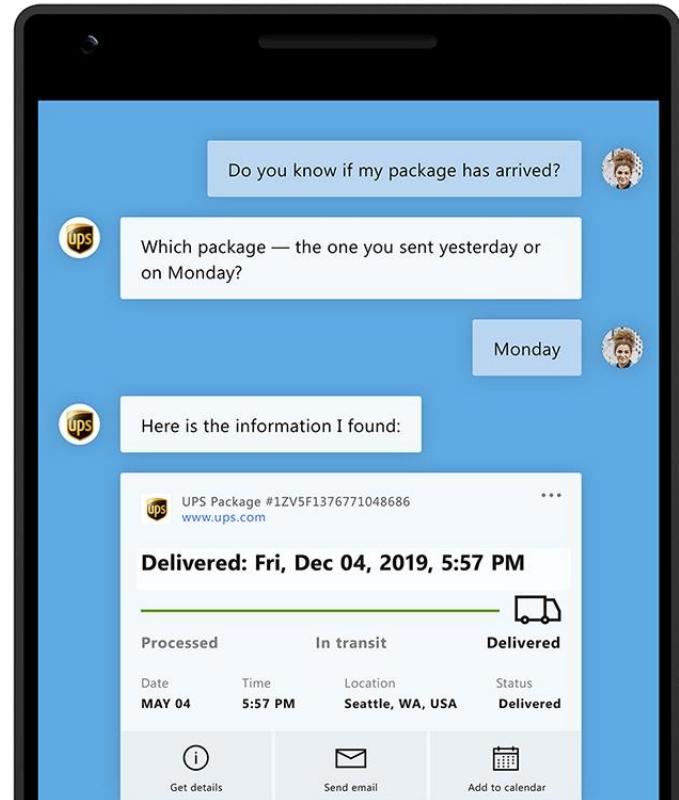
- ❑ **Cognitive Search** is used for data storage and search.
- ❑ Cognitive Search stores the QnA pairs and maintains indexes for all published knowledge bases.
- ❑ When a new query is raised by QnA Maker resource, Cognitive Service handles its execution to provide rich search experience.

- ❑ **App Service** enables access to the published knowledge bases of QnA Maker service via runtime query prediction endpoints.

- ❑ **Application Insights** is used for query prediction telemetry.
- ❑ Application Insights can collect chatbot's logs and telemetry.
- ❑ It also includes powerful analytics tool to diagnose potential issues and process telemetry data with KQL (Kusto Query Language).

Bot Framework

- ❑ Bots provide an experience that feels less like using a computer and more like dealing with a person - or at least an intelligent robot.
- ❑ The bot reasons about input and performs relevant tasks. This can include asking the user for additional information or accessing services on behalf of the user , such as taking a dinner reservation or gathering profile information
- ❑ Bots can do the same things other types of software can do - read and write files, use databases and APIs, and do the regular computational tasks.
- ❑ Users converse with a bot using text, interactive cards, and speech.
- ❑ A bot created with the Azure Bot Framework SDK can be integrated with Language Understanding (LUIS), QnA Maker or Power Virtual agents.



Knowledge Check

Question: In which two ways could you natively populate a QnA Maker knowledge base? Each correct answer presents a complete solution.

Choose the correct answers

- A. Using a SharePoint list
- B. Using a SQL database
- C. Using a PDF document
- D. Manually adding question and answer pairs

Question: Which two Azure resources are created when a new QnA Marker service is created? Each correct answer presents part of the solution.

Choose the correct answers

- A. Azure Key Vault
- B. Web App Bot
- C. App Service
- D. Azure Cognitive Search

Knowledge Check

Question: For each of the following statements about Azure Bot Services, select Yes if the statement is true. Otherwise, select No.

Statement
The QnA Maker app can only use one knowledge base.
A knowledge base supports multiple languages.
A knowledge base consists of question and answer pairs.

Question: Which two Azure cognitive services should you combine so that your chatbot can determine user's intentions and find answers from a custom knowledge base? Each correct answer presents part of the solution.

Choose the correct answers

- A. QnA Maker
- B. Language Understanding Intelligence Service (LUIS)
- C. Text Translator
- D. Speaker Recognition
- E. Form Recognizer

Knowledge Check

1. Your organization has an existing frequently asked questions (FAQ) document. You need to create a QnA Maker knowledge base that includes the questions and answers from the FAQ with the least possible effort. What should you do?
 - Create an empty knowledge base, and then manually copy and paste the FAQ entries into it.
 - Import the existing FAQ document into a new knowledge base.
 - Import a pre-defined chit-chat data source.

2. You need to deliver a support bot for internal use in your organization. Some users want to be able to submit questions to the bot using Microsoft Teams, others want to use a web chat interface on an internal web site. What should you do?
 - Create a knowledge base. Then create a bot for the knowledge base and connect the Web Chat and Microsoft Teams channels for your bot
 - Create a knowledge base. Then create two bots that use the same knowledge base - one bot connected to the Microsoft Teams channel, and the other to the Web Chat channel.
 - Create two knowledge bases with the same question and answer pairs. Then create a bot for each knowledge base; one connected to the Microsoft Teams channel, and the other to the Web Chat channel